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RECENT STUDIES OF THE VERTEBRATE HEAD.

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THE view that the vertebrate head is composed of several segments, comparable to those of the trunk, has of late years formed the basis of almost innumerable essays; but the problems connected therewith cannot yet be regarded as solved. It is, indeed, universally admitted that the head is composed of segments or metameres; but the number of segments and the limit of each segment are points upon which there is far from unanimity of opinion. A study of the skull, as was first pointed out by Goethe, leads to one conclusion, while a study of the muscle-plates or myotomes of the embryo gives greatly different results. Then the brain itself in its early stages shows marked evidence of metamerism, while the nerves arising from the brain can be more or less clearly divided into segmental groups which can be compared to the undoubtedly segmental spinal nerves.

In the following pages I have presented, in a very condensed form, the results of some recent studies in this direction. In these abstracts the nerves are referred to by Roman numerals, in accordance with the commonly received ideas of their sequence: I., olfactory; II., optic; III., oculomotor; IV., trochlearis; V., trigeminus; VI., abducens; VII., facial; VIII., auditory; IX., glossopharyngeal; X., vagus; XI., spinal accessory; XII., hypoglossal.

In the lizard, according to Hoffmann ('88–'89), the myotomes of the head agree very closely with the same in the chick

and Selachians. But the fourth seems to be wanting, and corresponding in position to the third myotome are two small cellular masses, not connected with each other, out of which are developed the muscles externus rectus and retractor bulbi. Between the vagus nerve and the first cervical spinal nerve are four myotomes, the cephalic of which is rudimentary. The oculomotor, trochlear, and abducens nerves are not described in their earliest stages. The III. with a broad origin springs from the base of the midbrain, and innervates the muscles derived from the first head-cavity. The IV. arises as a large cellular outgrowth from the place where the roof of the midbrain passes into the hindbrain, and resembles in every respect the "Anlagen" of the dorsal cranial nerves, sending an extension to the epidermis. The absence of a trochlear ganglion in the serpent, bird, and Selachians, and its presence in the lizard, gives rise to the query whether the trochlear nerve may not primarily have been the motor nerve of the protective organs of the parietal eye. The VI. springs by 10–12 fine fibres from the base of the medulla oblongata, and innervates the muscles derived from the two cellular masses that appear to belong to the third head-cavity. The V., VII.–VIII., IX., and X. nerves take their origin from the neural ridge, in a manner similar to the dorsal roots of spinal nerves, and their respective ganglia unite with the epidermis above the branchial arches. Between the V. and VII.–VIII. the neural ridge early aborts. The ophthalmic ganglion of the V., from its development on a dorsal root and its anastomosing with the III. nerve, a ventral root, is regarded as homologous to a dorsal ganglion. The ganglion of the VII.–VIII. nerve divides into two portions, the anterior part being the proper ganglion of the facial nerve, the other forming the auditory ganglion. The accessorio-vagus nerve arises by a broad base extending from the IX. nerve to the second cervical spinal nerve. Later the neural ridge loses its connection with the brain, and becomes a commissure between the second cervical nerve and the caudal vagus root, so the X. nerve then arises by 5–6 roots. The hypoglossus originates by four roots, the caudal root being a branch of the first cervical spinal nerve. Anterior to the roots of the hypoglossus are two rudi-

mentary somites, to the caudal of which apparently belongs a nerve of transitory duration. Froriep had already discovered four somites in the occipital region of the chick, but it will be seen that in the lizard there are five somites in this region. The two cephalic roots of the hypoglossus possess neither ganglia nor dorsal roots; the condition of the third root in this respect has not been determined; the first cervical nerve has a transient ganglion, and the second cervical a permanent ganglion. The hypoglossus thus seems to represent a complex of true spinal nerves, whose ganglia and dorsal roots have partially or completely degenerated. According to Hoffmann ('89), on the hinder portion of the lizard's brain appears an evident segmentation. Other authors had previously noticed this. Hoffmann finds in the hindbrain and medulla seven segments. From the caudal of these springs the X. nerve; from the next, or sixth, the IX.; opposite the fifth is the ear vescicle; from the fourth arises the VII.–VIII.; from the third none; from the second the V.; from the cephalic border of the first segment the trochlear nerve primarily takes its origin, though later shifting over to the midbrain.

Rabl ('89) considers the vertebrate head as consisting of two regions: a cephalic or proximal unsegmented, and a caudal or distal segmented region.[1] The ear vescicle forms the boundary between the two portions, but is to be reckoned with the proximal. The mesoderm of the proximal section may be divided into segments which neither in mode of origin nor in further development can be compared with protovertebræ. The five distal somites arise exactly as the protovertebræ. The first protovertebra to appear is the fifth head somite of Van Wijhe, or the first distal somite. The musculature and connective tissue of the distal somites develop in the same portions as in the protovertebræ of the body. Dorsal and ventral nerve roots occur in this region as in the body. In their origin the proximal somites show scarcely even a distant relationship with the structure of protovertebræ. The proximal somites cannot be called primary, for they appear later than the protovertebræ. The muscles of the proximal re-

[1] Kastschenko had observed in Pristiurus and Scyllium that at no period did the mesoderm of the anterior portion of the head appear segmented.

gion arise almost entirely in portions where in the protovertebræ connective tissue originates, and vice versa. There is no differentiation of myotomes and sclerotomes in the proximal somites. There are two primary nerves in the cephalic portion, the V. and VII.–VIII., but these do not arise from a continuous neural ridge. The cephalic border of the neural ridge forms a delicate strand uniting with the triangular part of the trigeminus Anlage, which becomes the ciliary ganglion. In later stages, answering to the direction of this delicate strand, extend the oculomotor and trochlear nerves. The oculomotor and trochlear nerves are thus to be considered as secondarily derived from the trigeminus, and the eye-muscles perhaps from the musculature of the first branchial arch innervated by the V. From researches on Selachians, birds, and mammals it is concluded that the III. and IV. nerves arise on the dorsal border of the midbrain. The primary nerves of the caudal region of the head are the IX., X., and hypoglossus, the latter consisting of the ventral roots of the region. The IX. and X. arise from a continuous neural ridge in a series with the dorsal roots of the true spinal nerves. The opinion of Beard, that the "Anlagen" of the dorsal cranial and spinal roots develop prior to and independent of the neural tube, is erroneous. The homology of the spinal ganglia to the parapodial ganglia of Annelids cannot be established till it is proved that the spinal ganglia grow out of the ectoderm independent of the neural tube. Rabl bases his observations on embryos of *Torpedo ocellata*. The unsegmented mesoderm of the head in the Craniota he compares with the unsegmented forward extension of the first primitive segment in Amphioxus. In the head region of Amphioxus are two stout nerves, which cannot be compared with spinal nerves. Rabl thinks they may be homologous with the V. and VII.–VII. of the Craniota.

In reply to Rabl, Dohrn ('90*a*) notes that the former repeats the mistake of Balfour in deriving the dorsal roots of the spinal nerves from the neural ridge. In all Selachians the dorsal roots of the spinal nerves grow out of the ganglia into the neural tube. The sensory fibres of the cranial nerves (V., VII.–VII., IX., and X.) grow out from the ganglia into the brain, while the motor fibres spring from the cells of the lateral columns and enter the ganglia.

The neural ridge arises as a cell-growth from the closing portion of the neural tube, as Rabl says. Neither His's "Zwischenstrang" nor Beard's ectodermal ganglion-anlage theory is tenable. The cells of the neural ridge, that do not form ganglia, atrophy. The neural ridge may thus be regarded as merely the forerunner of the ganglia. The gaps between the Anlagen of the V., VII.–VIII., and IX. nerves do not prove the absence of a continuous neural ridge in that region, but rather are points of atrophy. Rabl is correct in saying that a nerve-strand arises at the cephalic border of the neural ridge. The cell-mass from which this springs is anterior to the ciliary and gasserian ganglion Anlagen. In Torpedo a true ganglion is found derived from this cell-mass, but it later loses connection with the neural tube and neural ridge. After isolation nerve-fibres grow out from this ganglion, thus proving that sensory nerve-fibres and sensory root-fibres arise not from the neural tube, but from the cranial and spinal ganglia. The fibres of this isolated ganglion enter into such close relation with the trochlear nerve as to appear to belong to it. This ganglion and its outgrowth of fibres appear to represent the nerve ophthalmicus superficialis minor. The III. nerve arises by 3–7 roots from the base of the midbrain, and no medullary cells pass out with it. The ganglion, which seems to belong to this nerve, is really derived from the ciliary ganglion. The III. and IV. do not have their origin in the cephalic portion of the neural ridge. The VI., as well as the III., spring from the anterior column of the medulla oblongata. It arises by 4–6 roots. The hypoglossus is in no way connected with the vagus. It is to be regarded as formed from the ventral roots of one or more spinal nerves, as Balfour thought. Van Wijhe found extending over the eighth and ninth myotomes an outgrowth of the neural ridge, interpreted by him as representing rudimentary ganglia of the second and third hypoglossal roots. Froriep first established the existence of rudimentary ganglia of the hypoglossus. Ostroumoff finds in Pristiurus two spinal ganglia answering to the last two roots of the hypoglossus. Dohrn states that the hypoglossus has as many ganglio Anlagen as there are ventral roots, the first being merely a thickening of the neural ridge. It is impossible to

classify the V. and VII.–VIII. nerves in contrast to the IX. and X. All four are connected with the organs of the lateral line, while the spinal nerves take no part in the latter structures. The motor roots of all four spring from the lateral column, and pass into the ganglia, while no motor fibres go into the spinal ganglia. In Selachians, at the time the sensory roots of the glossopharyngeus and vagus enter the medulla oblongata, there appears in this region a folding or furrowing of the walls of the neural tube, similar to that seen in the spinal cord. In this segmentation the roots of the IX. and X. nerves correspond in position to the furrows separating the metameres, just as the furrows in the metamerism of the spinal cord answer to the sensory nerve-roots. The probability that the vagus is a polymere whose components were originally similar to spinal nerves, the similarity of the V. and VII.–VIII. nerves to the IX. and X. in development and functional differentiation, and the fact that the neural ridge can be traced anteriorly into the VII.–VIII. anlage, render Rabl's hypothesis of unsegmented cranial mesoderm untenable.

Dohrn's recent contributions ('90*b*) to our knowledge of primitive cranial segmentation must be regarded as epoch-making. In embryos of *Torpedo marmorata*, stage F of Balfour, 12–15 myotomes are found anterior to the glossopharyngeal region. Rabl refused to refer any segmentation to this region. Van Wijhe found four somites. These 12–15 myotomes pass ventrally into the lateral plates, which form the cranial cœlom, and out of which come the "head-cavities." In stage G the myotomes are considerably coalesced, and the more the development goes on the more the obliteration of myotome boundaries. Van Wijhe's mandibular somite is made up of 3 myotomes, the hyoid of 3, and the fourth somite of 2–3. The segmentation recognized by Van Wijhe is thus apparently secondary. The myotomes of the head are throughout comparable to the myotomes of the body. The cranial motor nerves show a metamerism. The III. nerve arises by 4–7 separate fibres, and innervates the muscles of the premandibular head-cavity, which is a multiple of myotomes. The VI. originates also as a multiplex of fibres, and innervates the

muscles of the third head-cavity, which is also composed of several myotomes. Both nerves spring from the anterior columns, and are homodynamous with motor spinal nerves. The IV. nerve emerges on the dorsal border of the brain, but whether it is homodynamous with the cranial ganglionic motor fibres, or with the motor spinal nerves, is uncertain. The ganglionic motor fibres, viz., those of the V., VII.–VIII., IX., and X., arise from the lateral columns. These fibres greatly converge in passing to the ganglion-anlagen of the respective nerves, and it may be assumed that at one time the fibres arose as separate nerves, each belonging to its myotome. Marshall believes the olfactory nerve to be an outgrowth from the anterior portion of the neural ridge. Beard advances the same view. His found that in human embryos the olfactory ganglionic cells and nerve-fibres originated from the epithelium of the nasal vescicle. Dohrn confirms the same in Selachians. Rudimentary ganglia are found in the anterior part of the V. Anlage, in the anterior part of the VII. Anlage, and in the anterior part of the IX. and X. We see indications of a centralizing process which has resulted in the reduction in number of the primitive ganglia. Displacement and suppression has taken place in the visceral mesoderm of the head. The premandibular, mandibular, and hyoid head-cavities are to be considered as multiples of original head-cavities, in which serial origin the lateral plates share. The fact that the embryonic vascular system is similar throughout would indicate that it originated at a time when the body was not yet differentiated into metameres. The difference in direction of the blood-currents in the aorta and the carotids can be explained by the hypothesis that the current in the latter has been reversed by the suppression of preoral arterial arches. By this hypothesis it may be assumed that at one time there was no separation between aorta and carotids. In consequence, the existing mouth is derived from the coalescence of one or more pairs of gill-clefts, and there must have been a time when the present mouth did not exist. Thyroid and hypophysis must have had a bilateral structure, so that a median passage could be left for the conus arteriosus. The aorta shares in two segmentations: one that of the

branchial arches, the other that of the vertebral arteries; the one of the branchiomeres, the other of the myotomes. The existing branchiomeres do not appear to be secondary to the myotomes, but secondary to primary hypothetical branchiomeres. In the hyoid and mandibular arches, and in the region of the head-cavity supplied with the III. nerve, are to be assumed a greater number of primitive branchial clefts. Hyoid and spiracular clefts are to be considered as multiples of branchial clefts. The irregularity seen in the posterior branchial arches is connected with the changes that have caused the coalescing of branchial arches. Thyroid, mouth, hypophysis, and nose are evidently related to the branchial system. Gegenbaur holds that the branchial skeleton is secondarily derived from ribs. But the ribs are dorso-lateral structures, and the branchial arches ventral. If the latter are secondary articulations of the vertebral column, then traces of the apophyses should be found. But as this does not occur, the branchial skeleton is to be regarded as of independent origin. The hyoid and mandibular cartilages then represent multiples, and cartilaginous girdles, which have functioned as branchial arches, now enter into the composition of the skull.

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(*To be continued.*)

SOME OF THE CAUSES AND RESULTS OF POLYGAMY AMONG THE PINNIPEDIA.[1]

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SEVERAL years ago the writer was much struck by the great sexual differences met with among the Gallinæ, and had noted the fact that there was a relation between sexual disparity in size and polygamy.

During the last summer an opportunity was afforded to carefully observe one species of the Pinnipedia, and these observations led to a perusal of all the available literature for facts concerning the relation between sexual disparity and polygamy in this order. The results of this study had already been outlined for a paper to be read before the Iowa Academy of Sciences, when an article appeared in the November number of the NATURALIST entitled "Probable Causes of Polygamy Among Birds," by Samuel N. Rhoads.

The above facts are mentioned to show that the conclusions as to the cause of polygamy among birds on the one hand, and Pinnipedia on the other, were the result of independent investigations, and hence will serve to strengthen each other in some important particulars.

True polygamy is something of a rarity among the Mammalia. It must not be confounded with mere promiscuous sexual intercourse, such as is often met with among the Herbivora. The term polygamy, in its strict sense, can properly apply only to those species in which a single male habitually copulates with several females, and jealously and persistently defends them from the approach of other males.

The most typical examples of this state of affairs are met with among the Pinnipedia, and ultra polygamy is exemplified by the northern fur seal (*Callorhinus ursinus*).

Two striking facts at once arrest the attention of even the most cursory observer of this species :

1st, The astonishing extent to which polygamy is carried.

[1] Paper read before the Iowa Academy of Sciences, Jan. 1st, 1890.

Mr. Elliott thinks "that it will be nearly correct to assign to each male from twelve to fifteen females, occupying the stations nearest the water, and those back in the rear from five to nine. I have counted forty-five cows all under one bull."[2]

2nd, The no less astonishing disparity in size between the sexes. The average length of the male is 7½ feet, while that of the female is 4 feet. The male weighs 450 lbs., while the female weighs only 85 lbs. It will thus be seen that the male weighs nearly *six times* as much as the female.

Two questions arise in view of the above facts:

1st, Is there any relation between polygamy and sexual disparity in size? 2nd, If so, what is that relation?

The Pinnipedia are fortunately sufficiently numerous in species and individuals to furnish an ample field for the study of both of the above questions. They are all eminently gregarious in habit, a condition favorable to polygamy. The order furnishes examples of both monogamous andpolygamous species, and almost every degree of sexual disparity in size to be found in the Mammalia. We can easily construct a series of species, ascending from those exhibiting the least sexual disparity to those exhibiting the greatest. We can then see what, if any, relation exists between sexual disparity and polygamy. We shall presently see that pugnacity on the part of the males plays a not unimportant *rôle* in our discussion, and for that reason the fighting proclivities of the males will also be noted.

The following arrangement, then, illustrates what might be termed the ascending series of sexual disparity. The relation of the sexes (monogamy, promiscuity, or polygamy) and the relative pugnacity of the males in relation to other males of the same species will also be noted in each case.

Odobænus rosmarus (Walrus).

(*a*) Sexes nearly equal in size, the female not being notably smaller than the male. (*b*) Monogamous, according to the only

[2] Quoted from "Monograph of North American Pinnipeds" (Allen). Nearly all the material used in the above article has been taken from that work.

information at the disposal of the writer.[3] (*c*) Disposition not at all quarrelsome, the animals of both sexes being singularly good-natured and peaceable, "huddling together like so many swine," although they will fight fiercely in defence of their young.

Cystophora cristata (Hooded Seal).

(*a*) Considerable sexual disparity. The male is eight feet long, and the female seven feet. Weight of male, 450 pounds; of female, 200 pounds. (*b*) Probably monogamous, although there is no direct evidence at hand. There is at least nothing to indicate that they are polygamous in the sense used in this paper. (*c*) The males fight fiercely for the possession of the females.

Erignathus barbatus (Bearded Seal).

(*a*) Considerable sexual disparity. Length of male, ten feet; length of females, seven feet four inches. Weight of males, two-and-one-half times that of females. (*b*) Strictly polygamous, according to the single authority found. (*c*) Males often have severe battles, the strongest males driving away the younger.

Macrorhinus angustirostris (Sea Elephant).

(*a*) Great sexual disparity. The weight of the male is three-and-one-half times that of the female. (*b*) Polygamous.[4] Elliott says that they "resemble the sea lions in their breeding habits." (*c*) The males "fight desperately for the females."

Eumetopias stelleri (Steller's Sea Lion).

(*a*) Great sexual disparity. Length of males, twelve feet; of females, eight-and-one-half feet. Weight of male, three times that of female. (*b*) Strictly polygamous. This species maintains a regular harem, but "does not maintain any such regular system in preparing for and attention to its harem as is illustrated on the breeding grounds of the fur seal" (Elliott). (*c*) "The bulls fight savagely among themselves, and turn off from the breeding ground all the younger and weak males."

[3] Monograph of North American Pinnipeds, p. 107.

[4] "The sea elephants appear to be exceptional among the Phocidæ in the great disparity of size between the sexes, in which, *as well as in their breeding habits*, they closely resemble the Otaries." Monograph of North American Pinnipeds (Allen), p. 755. The italics are mine.

Callorhinus ursinus (Northern Fur Seal).

(*a*) Extreme sexual disparity. The males weigh three times as much as the females. (*b*) Ultra polygamous, the males maintaining a large harem, and guarding the females with the greatest vigilance and courage. In fact, this animal is the most polygamous of all the Mammalia. (*c*) Males fight with greatest desperation and persistence for females.[5]

A consideration of the above series will disclose the fact that there is a close and constant relation between polygamy and disparity in size among the Pinnipedia. It also indicates that this relation is a *direct* one, the disparity increasing *pari passu* with the polygamy throughout the series. Another fact is rendered evident by this series, and that is that the combativeness of the males increases *pari passu* with sexual disparity and polygamy.

These facts having been reasonably well established, it is possible to construct a hypothetical history of events which will illustrate the successive stages by which a species might pass from a simply gregarious habit, in which monogamy, or at least promiscuity, prevails, to the extreme of polygamy practiced by the northern fur seal. Such a transition may be conceived to take place by the following steps or gradations:

1st, An eminently gregarious species would offer more favorable conditions for the introduction of polygamy than a non-gregarious species. Our point of departure in this part of the discussion would then be a gregarious, monogamous species. If the principles deduced from an examination of the series presented in the first part of this paper be correct, this species should also be one in which there is little sexual disparity, and little or no fighting among the males for the possession of the females. All of the above conditions seem to be fulfilled in the case of the walrus (*Odobænus rosmarus*). This species will then stand for our point of departure.

2nd, The gregarious habit of the walrus offers a constant opportunity for a departure from the path of monogamous rectitude. This fact is well illustrated in human affairs by the great

[5] Elliott says that he has seen one male fur seal fight fifty or sixty battles during a single season.

amount of social immorality found among the crowded tenements of our large cities. Constant opportunity offers the most powerful temptation to gratify desire, and this is doubtless as true among Pinnipedia as among men. The result of this is a departure from strict monogamy in the direction of promiscuity.[6] The harbor seal (*Phoca vitulina*) illustrates this stage in the process. So far as I can ascertain, this species is simply promiscuous in sexual affairs, but does not attain to polygamy in the sense used here. The sexual disparity is slight, the males being somewhat heavier, and but little, if any, longer than the females.

3d, The departure from monogamy in the direction of promiscuity results in constant rivalry on the part of the males to possess the most attractive, or the greatest number, of the females. Rivalry begets warfare, the world over. This purely individual and personal rivalry among the male Pinnipedia results in individual combats, in which courage, ferocity, and size are the controlling factors. We thus have instituted the most rigorous kind of sexual selection, by means of which the above desirable qualities are secured, propagated, and intensified on the part of the males. The females, on the contrary, seem to be practically passive. The writer has been unable to find any evidence that the female Pinnipedia exercise any choice in the matter of accepting or rejecting individual successful males. The sexual selection thus instituted is true sexual selection as defined by Darwin as follows: "This [sexual selection] depends on the advantage which certain individuals have over other individuals of the same sex or species, in *exclusive relation to reproduction*."[7] It differs, however, from a vast majority of instances of sexual selection in apparent absence of choice on the part of the female.

This stage in the development of polygamy is illustrated by the hooded seal (*Cystophora cristata*), which appears to be promiscuous in sexual matters, and in which the males fight fiercely for the possession of the females. The divergence in sex has become considerable, as already indicated, the males being more than twice as heavy as the females.

[6] This word, although questionable, is the only one known to the writer by which the meaning, indiscriminate intercourse, can be tersely expressed.

[7] The Descent of Man, p. 248. The italics are mine.

4th, The struggle for the possession of the females having become a fixed and intensified habit, and the sexual disparity continuing to grow more pronounced, the following results might be expected:

(*a*) The larger and lustier males would have their desire greatly intensified and their sexual powers appreciably increased.

(*b*) The smaller and weaker males would be crowded to the wall, and, in many instances, entirely deprived of all conjugal rights, which would be usurped by the larger and stronger animals.

As a result of these conditions, certain males would obtain possession of several females, and deprive all other males of access to them. This would be *polygamy* in the sense used in this paper. The whiskered seal (*Erignathus barbatus*), in which the male weighs two-and-one-half times as much as the female, and polygamy prevails, would illustrate this stage in the process.

5th, Polygamy having become a fixed habit, all the conditions would tend to accelerate the divergence in size between the sexes. The selection by which the bulkiest and most pugnacious males would succeed in obtaining the females would be as rigorous as could well be conceived, and would result in very great sexual disparity. The males would become remarkably fierce and aggressive. The females, on the contrary, would become less and less disposed to offer any resistance to the males, and hence a remarkable difference in temperament would eventually separate the sexes. The males would be intensely pugnacious, jealous, and aggressive, while the females would be gentle, indifferent, and passive.[8]

Polygamy having become established, the causes or conditions which aided in its establishment would tend to its intensification to such an extent that some males would have scores of females in their harems, while others, indeed the majority, would be entirely deprived of marital rights. Such, in brief, is the state of

[8] Curiously enough, Darwin quotes Captain Bryant to the effect that the females of the fur seal "appear desirous of returning to some particular male" (Descent of Man, p. 257). A careful perusal of the detailed accounts of the habits of this animal collated by Allen, in his Monograph of North American Pinnipeds, fails to discover any exercise of choice whatever on the part of the female. It may further be said that even if she had a choice there would be no chance to exercise it, as she is immediately pounced upon by the nearest male upon landing, and usually handed about by the scruff of the neck by several males before finding her ultimate resting place.

affairs among the sea lions, of which the fur seal (*Callorhinus ursinus*) is the best example.

The above hypothetical history of events will serve to convey the writer's opinion as to what may have been the stages by which polygamy has arisen and become intensified among the Pinnipedia. For the sake of the non-scientific reader, it may be well to say that there is no intention to convey the idea that the fur seal was first a walrus, then a seal, and finally evolved into a sea lion or fur seal.

Two other points deserve mention in connection with this highly interesting animal.

The question naturally arises, Why do not the females increase in size by inheriting the increased bulk of the male? There are few more interesting and perplexing laws than those of inheritance, and among these one of the most elusive is the inheritance of certain characteristics by one sex alone. Darwin attempts to explain these facts by the hypothesis of pangenesis,—a theory which seems to have few, if any, supporters at present. Whatever may be the cause of the transmission of certain characters to one sex only, there are two facts that may help us to understand the disparity between the sexes of the fur seals:

1st, The great size of the male is purely a *secondary sexual character*, and as such would not be expected to be inherited by the female, whatever may be the reason or an ultimately found to explain the fact.

2d, Small size is of direct advantage to the female in this case, and hence a *natural* selection[9] would tend to intensify this feature, or what is practically the same thing, to keep the females from sharing in the increased size of the males.

The advantage referred to arises from the manner in which the females are handled by the males upon the landing of the former, which is described as follows by Elliott:

"The little cows have a rough-and-tumble time of it when they

[9] The selection here spoken of can hardly be termed a *sexual* selection, as the advantage accrues directly to the mother, and does not have the direct and exclusive bearing upon the reproductive act which is the essence of sexual selection. It is, of course, true that one sex alone is affected; but this fact alone is not sufficient to stamp it as sexual selection as set forth by Darwin.

begin to arrive; for no sooner is the pretty animal fairly established on the station of bull number one, when bull number two, seeing bull number one off his guard, reaches out with his long, strong neck and picks the unhappy but passive creature up by the scruff of hers, just as a cat does a kitten, and deposits her on his seraglio ground; then bulls numbers three, four, etc., in the vicinity, seeing this high-handed operation, all assail one another, and especially bull number two, and have a tremendous fight, perhaps for half a minute or so, and during this commotion the cow generally is moved or moves farther back from the water, two or three stations more, where, when all gets quiet, she usually remains in peace."

Allen also quotes Captain Bryant as follows: "Frequently a struggle ensues between the two males for the possession of the same female, and, both seizing her at once, pull her in two or terribly lacerate her with their teeth."

It is evident that the more easily and quickly the females can be moved the better for them, as they are thus more likely to avoid being lacerated by the males, either in being stolen from one by another, or in being fought over as described in the last quotation. If this is true, the lighter females would be less likely to be injured by the savage males, and hence the heavier ones would be weeded out by a natural selection, which by its constant action would go far toward accounting for the great sexual disparity exhibited by these animals.

The remaining fact demanding explanation is the wonderful ability of the male sea lions to endure long-protracted fasts. On this point Mr. Elliott says that they "abstain entirely from food of any kind or water for three months at least, and a few of them stay four months before going into the water for the first time since hauling up in May."

"This alone is remarkable enough, but it is simply wonderful when we associate the condition with the increasing activity, restlessness, and duty devolving upon the bulls as heads and fathers of large families. They do not stagnate, like bears in caves."

It seems highly probable that this astonishing ability to endure

protracted fasts is one of the results of the ultra polygamy practiced by these animals.

A marked intensification of desire seems to be one of the immediate concomitants of polygamy among animals. A writer in a recent number of the NATURALIST[10] says, in speaking of monogamous birds adopting a polygamous habit: "We may infer, therefore, that sexual power and high sexual characters go hand in hand, and that in proportion to the advance toward organic perfection virility increases."

The virility of the sea lion is probably more excessively developed than that of any other mammal. The sexual organization is of the most highly specialized type, and differs in some important particulars (*e.g.*, external scrotum) from most other Pinnipedia.[11]

This excessive virility might lead to the habit of abstaining from food in order to secure and then guard the females. This abstinence in its incipiency would not be of very great duration, but the period might be lengthened by almost imperceptible increments throughout hundreds of generations, until the surprising results noted above would be reached. The animals live on their own blubber during their long fast, and it is reasonable to suppose that the male progenitors of the sea lions which were the strongest and lustiest and possessed the most blubber would be able to outstay their rivals, and hence obtain possession of a greater number of females and beget a greater number of offspring than those having less strength and blubber. Thus a process of selection would be instituted whereby animals would eventually be produced possessed of sufficient blubber and endurance to survive the effects of even such phenomenal fasts as are endured by the fur seal of the present day.

In the preceding pages the writer has endeavored to account for the following peculiarities met with among the Pinnipedia:

1st, The relation between great sexual disparity in size and polygamy.

[10] AMERICAN NATURALIST, November, 1890, p. 1030.

[11] For further interesting particulars, see Monograph of North American Pinnepeds, pp. 382-405.

2d, The manner in which polygamy may have originated.

3d, The origin and effect of excessive pugnacity.

4th, The origin and advantage of great sexual disparity.

5th, The origin and advantage of the ability to endure long-protracted fasts.

The sexual disparity, excessive pugnacity, and ability to endure protracted fasts are all intimately related to polygamy, either as cause or effect.

Up to a certain point pugnacity and disparity seem to have acted as causes of polygamy. Beyond that point they seem to be effects of polygamy, or at least are accelerated or intensified by it.

The ability to endure long fasts would seem to be purely an effect of polygamy.

ON THE GENESIS OF THE CHROMATOPHORES IN FISHES.[1]

BY CARL H. EIGENMANN.

FOR several reasons pelagic eggs are more available for a study of the phenomena of color-formation than fixed eggs. Pigment is nearly always formed in pelagic eggs some time before hatching, and as the embryonic life is usually short and the eggs are transparent, the whole process from fertilization to hatching can be observed, without any great inconvenience, in the living egg.

In all pelagic ova with oil-globules observed by me pigment is deposited in certain cells before the time of hatching. In the eggs of three species of pelagic ova (Stolephorus) without oil-globules no pigment is formed several hours after hatching, while in *Fierasfer dubius* (?) without oil-globules, pigment is present at the time of hatching.

Only three colors have been observed in the eggs examined, viz., black, a brownish-yellow, and bright yellow. In the various species of Sebastodes (viviparous) only black pigment is formed, while in Atherinopsis black pigment alone is observed until near

[1] Notes from the San Diego Biological Laboratory, IV.

the time of hatching, when bright yellow pigment appears. In the pelagic ova observed, excepting Stolephorus, black pigment was always formed, but never in great quantity. In *Serranus nebulifer* (Fig. 34) only black pigment is formed before hatching, while in *Serranus maculofasciatus*, *Sciæna saturna*, and *Hypsopsetta guttulata* the few black cells are almost obscured by the great number of brownish-yellow cells. In those cases in which both black and yellow cells appear the black cells soon collect on the lower surface of the oil-globule and on the lower surface or back of the embryo, while the yellow cells are aggregated on top of the oil-sphere and on the ventral surface of the embryo,—a fact already observed by others.

Figs. 32 to 41 will give a fair idea of some of the various patterns the color-cells form in early stages. Figs. 33 to 40 represent nearly homologous stages of various embryos. The time required to reach these stages differs, however, vary greatly in the various species. Figs. 33, 34, and 40 represent larvæ between two and three days old, while Figs. 35 to 39 represent larvæ as many, or more, weeks old. The conditions of development also vary greatly in the larvæ selected for illustration. Figs. 33, 34, and 40 are all hatched from pelagic ova; Fig. 36 from ova which adhere together and are thus hatched in masses; Fig. 38 from ova with a mycropylar circlet of filaments; and Fig. 39 from ova with isolated filaments scattered over the entire zona; while Fig. 37 represents a viviparous fish just at the time of birth.

Viviparity does not affect the chromatophores immediately. In the rock cod (Sebastodes), Fig. 37, color is as well formed at the time of parturition as in some related viviparous species. In the Holconotidæ, on the other hand, color is not formed until quite late stages are reached, and the eyes are the first to be pigmented.

In all cases observed the chromatoblasts originate in the mesoblast surrounding the embryo. This condition was considerably modified in *Sciæna saturna*, in which they are formed along the entire margin of the embryonic ring; but the difference is one of degree only.

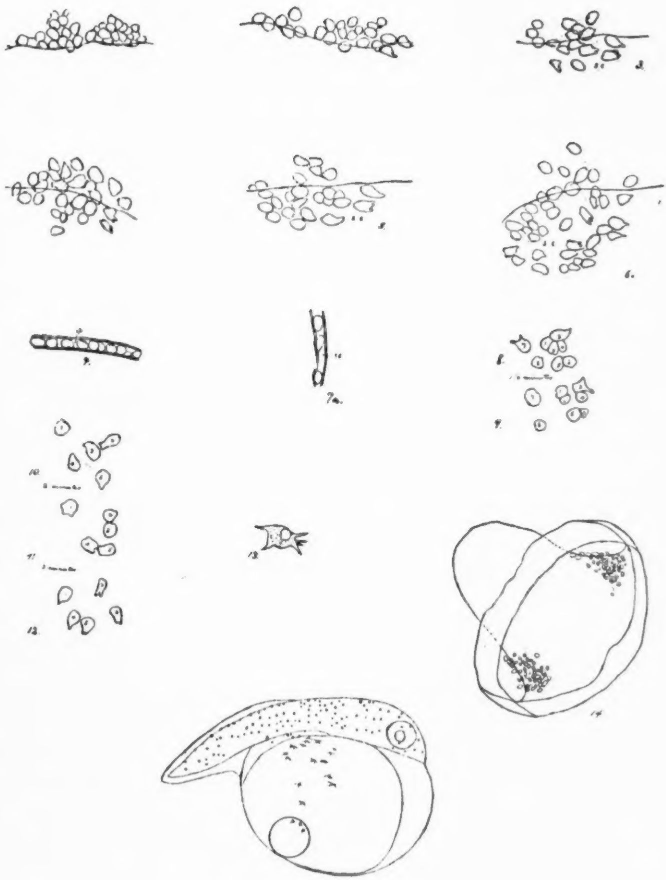
To follow the species observed separately:

In *Sciæna saturna* (Figs. 1–7) the chromatoblasts are first noticed when the gastrula covers about one-third of the yolk; that is, they appear quite early. They are formed along the entire margin of the embryonic ring. When first noticed they are slightly separated from the surrounding cells, and their outlines become well defined. They thus appear larger than the cells surrounding them, which are closely packed and whose outlines are not sharply defined. They either move toward the outer rim of the embryonic ring or remain stationary, while the embryonic ring moves over the yolk. At any rate, they soon come to lie entirely in the segmentation cavity, (see Figs. 1–7). At this time they are quite regular in outline, with probably one or two angular prolongations. Their depth is usually equal to that of the segmentation cavity, and much greater than the epiblast below them or the ectoderm above them. As soon as they have reached the segmentation cavity they migrate in it, most of them being intended for the embryo, while many remain on the yolk, and others cover the oil-globule.

While the individual cells undergo amœboid changes, their locomotion is not necessarily caused, as some observers supposed, by their amœboid changes. One cell, which was smaller than usual, was seen to move quite rapidly towards the oil-globule, with a motion not unlike that of ciliate Infusorians caught under a cover-glass; *i. e.*, it moved quite rapidly, and then seemed to be momentarily arrested by some invisible barrier, when it would again dart along. When the cells are first freed from the embryonic ring no color is seen in them; but before long fine granules are observed, resembling in most respects the minute oil-globules covering the yolk. Individually these are apparently colorless, but collectively they form yellow or black pigment. On the oil-globule and embryo, and later over the yolk also, the cells become flattened, more densely pigmented, and at the same time gain the power of contracting the pigment to a dot (Fig. 15), or expanding it to the dendritic form of the cell itself (Fig. 17).

I have not observed any other cells than the migratory ones in this species; if others exist, they were obscured by the large

PLATE III.



EMBRYOS OF FISHES.

quantities of migratory cells. I have not had an opportunity of reëxamining this species or Hypsopsetta since the species of *Serranus* were observed.

In *Hypsopsetta guttulata* the color-cells appear much later and not nearly in such large quantities as in Sciæna. They are first noticed when the gastrula covers only one-half or two-thirds of the yolk, and the migratory ones are formed only at or near the union of the embryonic shield and the embryonic ring (Fig. 14). Numerous cells are soon after seen along the entire embryo. I am not certain whether they originate *in situ* or whether they migrate to their position. Later, when the embryonic shield is contracted to form the embryo, these cells move toward it, and finally cover it. Later other cells again move out from the embryo to cover the yolk (see Figs. 15–17).

The observations on *Serranus nebulifer* (Fig. 34) were not very complete. Only black cells are formed, and very few cells become free from the embryo, all of which migrate to the oil-sphere.

In *Serranus maculofasciatus* (Figs. 18–28) the chromatoblasts were observed about sixteen hours after fertilization. There were at that time a few free ones on either side of the embryonic shields. In fifteen minutes the number of free ones on one side had increased from nine to fifteen (see Figs. 18–22). These cells moved rapidly away from their place of origin, and most of them finally, in about two hours and a half, were found on the oil-sphere. A few probably returned, and finally lodged in the region of the head. Besides these migratory cells, there is a broad band of mesoblastic cells along either side of the embryo in which color is soon formed. These cells never become nomadic in the segmentation cavity, but remain attached to the embryo, over which they are finally nearly evenly distributed. By far the greater portion are yellow cells, but a few being black. Before hatching these cells become collected into definite masses, and some time after hatching they assume the remarkable condition observed in Fig. 33.

So far as I am aware, nothing has been written concerning the origin of the color itself. As stated above, the color is not due to the color of the protoplasm of the chromatophores but to the aggregation of small granules, most probably oil-spherules. The

protoplasm is colorless. The color-granules are not found in the nucleus of the cells. They are sometimes scattered through the whole of the remainder of the cell, but can be withdrawn from the pseudopods of the adult chromatophore and collected in a small spot. It is to the ability on the part of the chromatophores to thus distribute or collect the color-granules that the larva owes its power to rapidly change color.

The individual spherule of the chromatophores does not possess any definite color. It is only, as has been stated, when a number of them are aggregated that color is evident. These granules are either a secretion of the cell itself, or they are formed otherwise and appropriated by the cell. The process of the formation of the granules in the chromatophores would, of course, be difficult to follow if they were secreted by the cell. On examining the medium surrounding the migratory cells for a possible explanation of the color-spherules, it was found that the epiblast was full of granules or oil-spherules, similar in size and but slightly, if any, different in refractive index. Such spherules were especially abundant in Sciæna, in which there is also an unusual number of color-cells. Especially towards the closing of the blastopore, a large number are seen over the entire portion of the yolk not covered by the gastrula, and it seems as though the advancing embryonic ring were heaping them up at the entodermic pole of the egg.

I have frequently observed individual chromatophores while in the segmentation cavity, and have seen them put forth pseudopods and withdraw them independently of their locomotion; but I have never seen them in the act of appropriating any of the spherules of the epiblast.

There is a difference between the spherules of the yellow and of the black cells. The granules of the black cells are smaller and less refringent.

When first freed from the embryonic ring the color-cells usually approach the typical cell in shape, but later they become flattened and assume the dendritic form so characteristic in the larvæ.

These observations were made while at a distance from all scientific libraries. After they had been prepared for the printer,

PLATE IV.

EMBRYOS OF FISHES.

I was enabled, through the courtesy of Dr. C. O. Whitman, to examine the records of previous observations during my stay at the Marine Biological Laboratory at Woods Holl. Although I then found that many of my observations were but verifications of those of others, it has seemed best to publish my account because I have examined new material, have worked out the matter in greater detail in several species, and do not agree with the previous observers in all points.

Aubert,[2] Kupffer,[3] Agassiz and Whitman,[4] Wenkebach,[5] and List [6] all seem to agree in deriving the chromatophores from the mesoblast; as to when and where they arise these authors naturally vary with the different species examined.

All the figures, excepting 37, were made from living eggs or larvæ, with a Zeiss microscope and Abbe camera. The letters A and D refer to the objectives, the 2 and 4 to the oculars, of Ziess.

EXPLANATION OF PLATES.

PLATE I.—*Sciæna saturna.* Figs. 1–6, a portion of the embryonic ring, showing the chromatophores. In Fig. 1 they are all still contained in the embryonic ring. In Fig. 2 a few are seen entering the segmentation cavity. Figs. 3 and 4 show a portion only of the region covered by Figs. 1 and 2, with more cells in the segmentation cavity, Fig. 4 being drawn five minutes later than Fig. 2. Figs. 5 and 7 show still later stages, in which a still larger number of cells have been freed; Zeiss, D and 4. Fig. 7, an optical section of the segmentation cavity (s. c.), near the embryonic ring, showing the large chromatophores, the thin ectoderm lying above them, and the parablast below them. Fig. 7*a*, the same at some distance from the embryonic ring, the chromatophores being much less numerous. Fig. 8, a series of eight free chromatophores of *Hypsopsetta guttulata;* D and 4. Fig. 9, the same cells 1½ minutes later. Fig. 10, a series of five chromatophores. Fig.

[2] Beiträge zur Entwickelungsgeschichte der Fische. *Zeitschr. f. wissensch. Zool.*, VII., 1856.

[3] Beobachtungen über die Entwickelung der Knochenfische. *Arch f. mikr. Anat.*, IV., 1868.

[4] The Pelagic Stages of Young Fishes. Mem. Mus. Comp. Zool., pp. 7 and 40, 1885.

[5] Beiträge zur Entwickelungsgeschichte der Knochenfische. *Arch. f. mikr. Anat.*, XXVIII., 1886.

[6] Zur Entwickelung der Knochenfischen (Labriden). *Zeitschr. f. wissensch. Zool.*, XVL., 1887.

11, the same two minutes later. Fig. 12, the same three minutes later than Fig 11. Fig. 13, a single chromatophore, more highly magnified after pigment has begun to be formed. Fig. 14, outline of embryonic shield and ring, with chromatophores beginning to be freed; A and 4. Fig. 15, a larva just freed from the membrane, 1.4 mm.; the chromatophores contracted.

PLATE II.—The same larva (Fig. 15) twenty hours afterwards, 1.6 mm. Fig. 17, another more advanced larva, 1.7 mm. long.

Serranus maculofasciatus.—The aim being to show the chromatophores, the details of the embryo were not as well attended to as they otherwise would have been. Figs. 18–28 represent the successive positions of the free chromatophores from the time they become free till they have nearly reached the oil-sphere. The exact times when the drawings were made are indicated with the figures. The egg figured was probably fertilized at about 5 P.M. the day preceding the stages represented. Figs. 19–22 and 24 show merely one side of the embryonic shield. In Fig. 25 the lateral cells have begun to be pigmented Figs. 18–26, Zeiss, A and 4; Figs. 27, 28, A and 2.

PLATE III.—Fig. 29, slightly older egg than Fig. 28; A and 4. Fig. 30, the free chromatophores have reached the oil-sphere, the yellow cells lying on the upper surface, the black on the lower surface; the chromatophores of the body have become more densely pigmented; A and 4. Fig. 30*a*, a chromatophore (the nucleus is not seen), with the color-granules from the oil-sphere of Fig. 30; D and 4. Fig. 30*b*, another chromatophore, showing nucleus, also from oil-sphere of Fig. 30; D and 4. Fig. 31, a later stage, the yellow cells having aggregated in large masses; A and 4. Fig. 32, immediately after hatching, the yellow cells being large, the black cells small, all the cells contracted; A and 4. Fig. 33, twelve hours after hatching, the cells expanded to their utmost and constantly changing; A and 4, 2.2 mm.

PLATE IV.—Fig. 34, a newly hatched larva of *Serranus nebulifer;* 2.67 mm. Fig. 34*a*, one of the chromatophores from the tail, more enlarged; D and 4. Fig. 35, *Oligocottus analis*, twelve hours after hatching; dorsal surface; X 25. Fig. 36, somewhat older *Oligocottus analis*, two days after hatching; lateral view; X 35. Fig. 37, *Sebastodes ruber*, at the time the larvæ are freed from the ovary. This is probably a pathological specimen; the tail is usually more elongate. Fig. 38, Lepidogobius sp., showing peculiar distribution of pigment; X 68. Fig. 39, *Atherinopsis californiensis*, after the yolk is all absorbed; Jan 9, 1889; X 12. Fig. 40, *Stolephorus ringens*, forty-eight hours after hatching; no color is formed in the latest stages observed. Fig. 41, *Hemisbamphus rosæ*, 12.5 mm. long, showing the distribution of the color cells; the cells of the posterior part of the body and of the tail are omitted.

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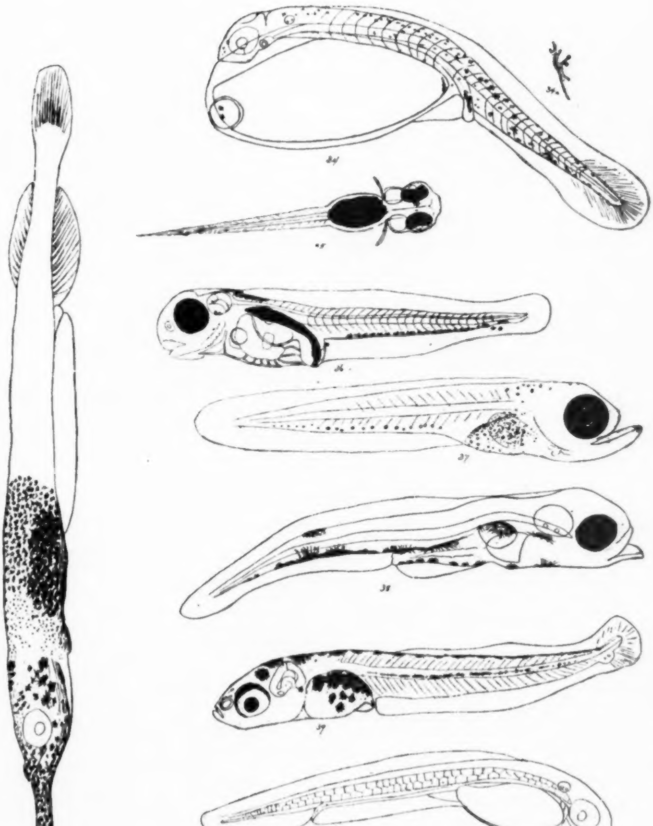
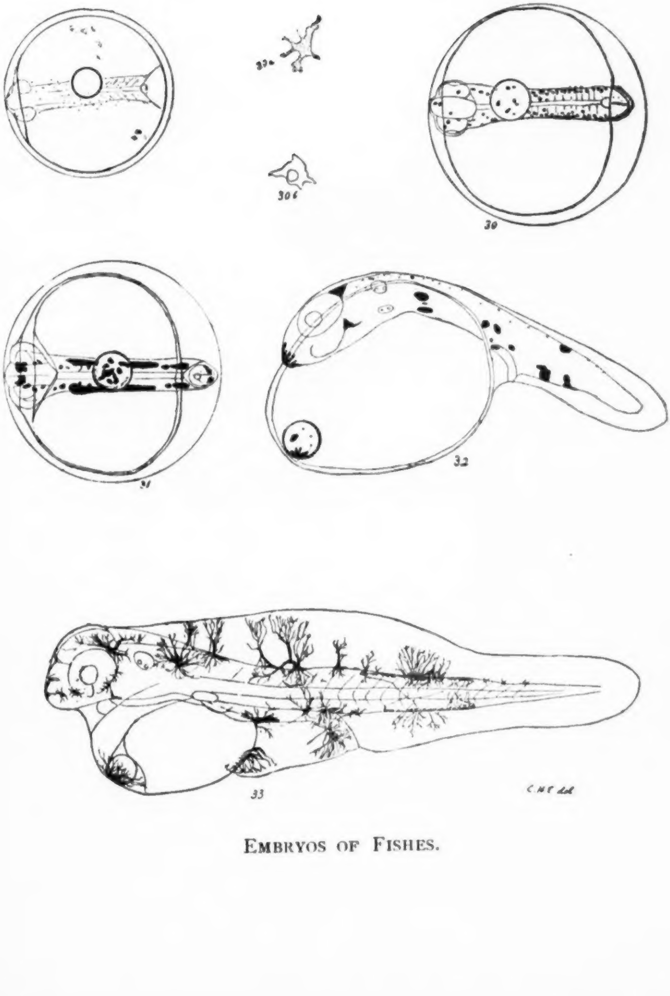
PLATE VI.



EMBRYOS OF FISHES.

PLATE V.



EMBRYOS OF FISHES.

AN INDIAN GRAVE IN WESTERN NEW YORK.

BY A. L. BENEDICT, M.D.

SOUTH of Lake Ontario, between the Genesee River on the west and Canandaigua Lake and its outlet on the east, lies a fertile country, studded with knolls and hills from twenty to two-hundred-and-fifty feet in height. West of the Genesee River, as far as Buffalo and Lake Erie, the land is level, with only occasional elevations to relieve the monotony. East of Canandaigua Lake the hills enlarge into miniature mountain ranges, five to fifteen miles long, four or five miles from valley to valley, and five or six hundred feet in height.

Nearly the whole of this region west of Seneca Lake was inhabited by the Seneca nation of the Iroquois, but only in the middle portion was there much communication between the Europeans and the Indians until late in the eighteenth century, when the usurpation of the land by the white settlers was accomplished in a comparatively short time. Hence, as a rule, the Indian village sites and burial places of the western and eastern portions of the Seneca territory yield relics of genuine aboriginal workmanship, whereas in the central portion, in which the Indian population held its own against foreign encroachment for more than a century, European influence is indicated by an abundance of iron axes and knives, glass beads, copper ornaments, brass kettles, and a variety of other articles found in connection with flint arrowheads, stone tomahawks, wampum, and unglazed pottery.

One of the largest and best-known sites of Indian occupancy in this region is on a large hill near the thriving village of Victor. Some idea of the importance of this Indian village may be derived from the following considerations: The hill is one of the most commanding localities in the whole middle territory, descending so abruptly on the west and north as to make it a vantage-point in case of war, sloping more gradually in other directions. At least ten acres of the hill-top were so densely populated that even at this late day, after half a century of cultivation and the visits of

two generations of relic-hunters, it still yields ample recompense in the form of beads, pipe-stems, pottery, and other implements to any one who will take the pains to search for them. On and near this village site so many iron tomahawks were found by the early settlers that they were of commercial value as old iron, and were by no means an insignificant source from which the blacksmiths derived the material for horseshoes and other articles of farm use.

The writer had made several visits to this place, and had gathered from the surface a considerable number of relics. In the spring of 1885 a young man of the locality exhumed a skeleton with which were buried two or three silver rings, and in September following the writer opened a grave almost adjoining the first one, with such rich results that he has thought it worthy of a descriptive article.

The graves were situated at the extreme western edge of the hill, four or five rods beyond the field in which the relics were so plenty, and a few feet before the slope, already begun, became so steep that ascent was difficult.

The writer, availing himself of the work of excavation which had been done in the spring, dug into the side of the grave, reaching, after a short time, a woodchuck hole, which fortunately led him to another skeleton. This skeleton, whose immature bones and teeth showed that it had belonged to a person between sixteen and twenty years old, was in the crouching attitude, with elbows at the sides and knees drawn up to meet them, characteristic of Indian burial. Strange to say, however, the skeleton was turned head downwards, a circumstance which has never been duplicated in the writer's experience.

One of the first objects exhumed was a bone head-comb, evidently either of European manufacture, or an imitation by the Indians of some similar ornament which they had seen the white women use. Several of the teeth of the comb had become broken, but otherwise it was well preserved. At the top of the comb there is a rudely cut figure of a man standing and resting his hand on the shoulder of another person who is on horseback. Beside the skeleton was a partially overturned brass kettle, con-

taining a hard discoid stone, presumably used to heat water, for only a few years previous to the time when this village was destroyed the Indians used clay kettles, which could not stand the heat of a fire, and they therefore heated water in them by throwing in hot stones. In and just outside the kettle was a quantity of large, red glass beads, of smaller glass beads, white, blue, green, and yellow, some spherical, some cylindrical in shape, and which, when strung, measured thirty feet. There was also a flat, white shell ornament in the shape of an isosceles triangle, with a hole near the apex. At the bottom of the kettle was a mass of decayed organic matter, which showed faint traces of interlacing fibres, and which was probably the remains of a basket or mat. The bail of the kettle was of iron, much corroded, for that metal is not nearly so enduring as copper or brass. The spongy fragments of a wooden handle were also found.

Seven slender bone or shell tubes were also found, some almost perfect, some worn and decayed so as to require the most careful handling. The longest of these measured four-and-one-eighth inches, the shortest unbroken one three-and-three-eighths inches. Nearer yet to the skeleton was genuine Indian wampum, both white and purple, showing in places, as it rolled out of the earth, the original arrangement into parallel rows of five or six beads. This when strung measured sixty feet, and when stitched on to cloth, in imitation of its arrangement at the time of burial, it would reach from one shoulder to the opposite hip, or several times around the waist of a small person.

Part of the upper rounded shell and most of the jointed under shell of a good-sized turtle were also exhumed. This turtle skeleton may have been part of a rattle, or it may have been a pet of the Indian girl, or, again, it may have been the symbol of the clan to which she belonged, for running through the six nations of the Iroquois were clans or brotherhoods taking their names from animals, and one of these clans was named from the turtle.

This grave was one of a number opened in the vicinity, and all, while differing in detail, agreed in presenting evidences of European civilization in conjunction with aboriginal customs.

Buffalo, N. Y.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

NOW that the first excitement regarding the new remedy for tuberculosis has subsided, the time seems opportune to glance back at the events of the past eighteen months, which have proved rich in scientific research in relation to the tubercle bacillus, and to place on record, not only for our own satisfaction, or even for those more immediately concerned, but especially for the benefit of succeeding generations, the announcements that have been made public from time to time in regard to that microbe, and the means that have been discovered for combating its ravages on the animal economy.

The endless and often embittered controversies which constantly occupy the literary world almost invariably arise from the fact that no plain contemporaneous record was made at the time, which would have placed the question beyond the range of argument. To cite a case in point, the circumstances surrounding the sale by Oliver Goldsmith of the "Vicar of Wakefield" have proved an inexhaustible field for conjecture and surmise, and gallons of ink have been wasted over the attempts to reconcile two apparently conflicting accounts of that transaction.

In almost all cases of discovery there are rival claimants,—in some instances, where the evidence seemed most conflicting, it has been afterwards proved beyond question that the same idea has come to two workers, hundreds of miles apart, at almost identical moments. A little consideration will show that there is nothing very surprising in this. In the case of two scientific men pursuing an investigation on similar lines and with an identical goal in view, it is perfectly possible for them to hit upon the same conclusion at nearly the same time, and for both of them to believe that the one has been pillaging from the other.

In the case of the discovery of vaccination, no serious question ever arose, and Jenner stands out alone without challenge or dispute. The same can be said with regard to the discoveries of

Pasteur; nor is there any doubt as to the claims of Professor Koch to the discovery of the tubercle bacillus.

In the month of March, 1882, Dr. Koch announced to the medical world that he had discovered the existence of a microbe hitherto unknown, and to which was given the name of the tubercle bacillus. He described how he had subjected diseased organs of numbers of men and animals to microscopic examination, and found, in all cases, the tubercles infested with a minute, rod-shaped parasite, which, by means of a special staining process, he differentiated from the surrounding tissue. He says: "It was in the highest degree impressive to observe in the center of the tubercle cell the minute organism which had created it."

Professor Klein differs from this view. He says: "I cannot agree with Koch, Watson Cheyne, and others, who maintain that each tubercle owes its origin to the immigration of the bacilli, for there is no difficulty in ascertaining that, in human tuberculosis, in tuberculosis of cattle, and in artificially induced tuberculosis of guinea-pigs and rabbits, there are met with tubercles in various stages, young and old, in which no trace of a bacillus is to be found, whereas in the same section caseous tubercle may be present containing numbers of tubercle bacilli."

Transferring directly by inoculation the tuberculous matter from diseased animals to healthy ones he in every instance reproduced the disease. To meet the objection that it was not the parasite itself, but some virus in which it was embedded, he cultivated his bacilli artificially for long periods of time and through many successive generations.

This was confirmed by reliable investigations, and thus was established the existence of the tubercle bacillus and its discovery by him, and up to this time everything is plain sailing.

From the date of this announcement (1882) by Professor Koch, up till October, 1889, nothing particularly new was heard on the subject, and as far as the literature on the tubercle bacillus goes, we have every reason to believe that the search for a toxic agent to combat the disease of tuberculosis and the ravages of the tubercle bacillus has been fruitless. Indeed, to all outside appearances, the tubercle bacillus, having been once discovered, was to

be left unmolested to pursue its ravages on helpless humanity. But in reality it was being followed up by tireless and relentless foes.

On October 19th, 1889, was published in the *Medical News*, of Philadelphia, by Dr. Samuel G. Dixon, at that time Professor of Hygiene to the University of Pennsylvania, a monograph announcing his discovery of the hitherto-unknown forms of the tubercle bacillus.

In the previous summer, whilst investigating different methods of technique and manipulation abroad, Dr. Dixon was led to believe that the bacillus could be cultivated so as to show lower forms of virulent life; and following this idea up by a series of experiments, he was in a short time able to produce the hitherto-unnoticed forms of the bacilli, some club-shaped, others curved, and others again branched.

From the growths thus obtained he proceeded to make a series of tube inoculations, from which he grew bacilli corresponding in every respect to the ordinary rod-shaped tubercle bacillus.

Having obtained these results, he propounded two hypotheses: 1st, That by a thorough filtering out of bacilli from tuberculous material a filtrate might be obtained and attenuated, so that by systematic inoculations a change might be produced in living animal tissues that would enable them to resist virulent tubercle bacilli. 2d, To bring about a chemical change or physical change in living tissues that would resist tubercular phthisis, it is possible that inoculation with the bacillus would have to be made; yet, before this could be done, the power of the virulent bacilli would have to be diminished, otherwise the result would be most disastrous. He added further that he had reduced the tubercle bacillus to a condition that, when inoculated into the animal economy, caused a resistance to the disease.

To use a military metaphor, this was the first note proclaiming that an active campaign had been opened on the tubercle bacillus, and specifying in terms as definite as possible the means by which the war was carried into the enemy's country.

The announcement of this discovery was widely circulated and commented upon, and reprints of the article were forwarded to

Drs. Von Pettenkofer, Koch, Louder-Brunton, and other scientific investigators.

The International Medical Congress was appointed to meet in Berlin in August, 1890, and more than usual interest attached to its meeting, as it was generally rumored that some important papers on the subject of the tubercle bacillus would be read on that occasion.

Nor was this rumor falsified, and the interest of the meeting may be said to have culminated as Professor Koch rose to address the assembled physicians, and when he stated that he had hit upon a substance which had the power of preventing the growth of the tubercle bacillus, it was greeted with loud applause. It was then stated that the bacillus of tuberculosis in man and chickens was very similar, and he inferred that the latter is a special species of the organic matter supposed to lie at the root of pulmonary consumption. He also announced that the direct action of solar light on the tubercle bacillus destroys in a certain length of time, varying from a few minutes to several hours, the virulence of this microbe.

It will be convenient to quote verbatim from that portion of the paper proclaiming his discovery of a toxic agent: "In spite of this failure—to effect any result on tuberculous animals with chemical substances—I have not allowed myself to be discouraged from prosecuting the search for growth-hindering remedies, and I have at last hit upon a substance which has the power of preventing the growth of tubercle bacilli, not only in a test tube, but in the body of an animal. All experiments in tuberculosis are, as every one who has had experience of them has sufficiently discovered, of very long duration. My researches on this substance, therefore, although they have already occupied me for nearly a year, are not yet completed, and I can only say this much about them, that guinea-pigs, which, as is well known, are extraordinarily susceptible to tuberculosis, if exposed to the influence of this substance, cease to react to the inoculation of tuberculous virus, and that in guinea-pigs suffering from general tuberculosis, even to a high degree, the morbid process can be brought completely to a standstill without the body being in any way inju-

riously affected. From these researches I in the meantime do not draw any further conclusions than that the possibility of rendering pathogenic bacteria in the living body harmless without injury to the latter, which has hitherto been justly doubted, has been thereby established." (Address before the Medical Congress in Berlin, August, 1890.)

It will be observed that Professor Koch in his paper makes two points: 1st, The action of solar light and a high degree of heat in destroying the virulence of the microbe; 2d, The fact that he had produced a substance the effect of which was to prevent the growth of the tubercle bacilli in the body of an animal, and that he produced a condition in that animal that was immune to the virulent tubercle bacilli; also that he by the same process could overcome tuberculosis already established.

There are also two facts that cannot fail to strike the observer. The first is, that a period of over seven years had elapsed from the date of his first publication on the tubercle bacillus and that announcing his discovery of the toxic agent; and the second, that his researches after the substance must have commenced about the period of Dr. Dixon's publication of October, 1889, of which, however, no mention is made in his address. It does not seem unfair to infer that Professor Koch had been unsuccessful during the preceding years in arriving at any satisfactory results. His own words, "My researches on this substance, therefore, although they have occupied me for nearly a year," etc., seems conclusive on this point. We do not, however, propose to do more than call attention to the coincidence of his researches after the toxic agent and the publication of Dr. Dixon's, October, 1889, the importance of which would be obvious to any bacteriologist, and the unfruitful nature of the former's investigations previous to that date.

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corpore vili, was prepared to inoculate the human subject. But the nature of his remedy and the method of its composition were to be kept a profound secret.

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An attempt to explain its probable action appears in an article I wrote for the *Medical News* of October 19th, 1889, and also in the *Medical and Surgical Reporter* and the *Times and Register* of this year. The views expressed are, however, purely hypothetical.

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The important question as to whom belongs the credit for it, and to whom should be awarded the priority, may well be left to them. We venture to think that the material is present here before them to enable them to form a correct judgment.

That the use of the remedy has not yielded the results expected from it by Prof. Koch is very probable, and it is difficult to avoid the reflection that a more conservative policy, such as that persistently advocated and followed by Dr. Dixon, would have been wiser, and moreover kinder to those whose hope of cure had been unduly raised. There is abundant work to be done yet in the laboratories before definite conclusions can be reached, and the inoculation into the human system is therefore to be deprecated as premature. That the main principle has been arrived at seems beyond doubt, but much yet remains before the discovery can become of permanent benefit to suffering humanity.

—IN these days of object teaching, science made easy, and German taught by the lightning method, it is not surprising to find that there are philanthropic men who will undertake to see a college graduate through commencement day—for a consideration.

That this long felt want has been filled is due to the enterprise of two Ohio men. Their circular announces that "the student of the present day finds that in doing justice to the physical man he has little time for literary work." There are those of us who had a lingering fancy that colleges were endowed and professors engaged to stimulate young men to mental labor. We are glad to be corrected, and shall, after this, adopt the more advanced views upon the subject.

These philanthropists admit "there *may* be students in every college who enjoy literary work," but their sympathies go out to "those who are obliged by a tyrannical college faculty to waste both mortal time and parental money in gorging a brain with a material that is as essentially foreign to that particular intellect as is sawdust to the human system." With a consideration born, perhaps, of experience, they agree to furnish to the possessors of these overworked brains already digested food, so that in the end they may put to shame the tyrannical faculty who are such fossils that they think a man goes to college to study.

The price of show brains is quite reasonable. Orations, essays,

debates, eulogies, invectives, sermons, political speeches, and lectures range from $3 to $50,—a graduated scale of prices to suit the parental pocket,—and all written by "two of the most prolific writers of the age," who will write anything and everything, on any and all subjects. These two men must belong to that misguided, behind-the-age set who enjoyed literary work at college. However, the point of it all is just this, now that the public know there is learning in the land to be had at so much per foot or yard of foolscap, it will no longer submit to the imposition of stupid, prosy essays on commencement days.

Do men gather grapes of thorns, or figs of thistles? Yea, verily, if they can pay for them.

—PROFESSOR J. W. SPENCER has had the usual difficulty experienced by all scientific men who hold political positions. The Treasurer of the State of Georgia forced a geological ignoramus on him as a subordinate, who calls quartz magnetite, silicified wood as lignite, slabs of feldspar as quartz, etc. The assistant's brother is a representative, and has been trying to groom the young man for State Geologist. He defeated the geological bill which abolished the political board. His testimonials were obtained under false pretences. But these are now exposed. The Governor is at Professor Spencer's back. What the Legislature will do in July is not yet known, but if it knows the true interest of the State it will permit Dr. Spencer to select his own assistants.

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WOOLMAN, L.—Geology of Artesian Wells at Atlantic City, New Jersey. Ext. Proc. Phila. Acad. Nat. Sci., March, 1890. From the author.

RECENT LITERATURE.

Justus Roth's "Allgemeine Geologie"[1] treats of the original crust of the earth and of the theory of metamorphism. In that part of the volume now before us the author maintains his position as one of the most indefatigable investigators of geological literature. As the result of his labors he has produced a book which at the same time is almost a complete index of the literature of metamorphism and a cyclopedia of the facts learned or surmised with respect to the phenomenon. To the plutonist it serves as a very welcome antidote to the great mass of neptunistic doctrine now penetrating the body of geological thought. In it is denied *in toto* the possibility of the alteration of a sediment into a crystalline-schist. The origin of those crystalline-schists that are not members of the original crust is ascribed in all cases to the dynamo-metamorphism of plutonic rocks. At the same time it is denied that pressure without attendant chemical action is able to produce such changes as are necessary in a rock to transform it from a granite or gabbro into a gneiss or a hornblende-schist. The necessary chemical action is thought to be sometimes the direct consequence of the pressure, and sometimes to be merely the ordinary processes of complicated weathering. No reliance is placed in the conclusion that the granulites of Saxony are regularly metamorphosed granites, or that the hornblende-schists are (as is supposed to be the case by Rosenbusch) "metamorphic facies of gabbro."

After discussing briefly the constitution of the original crust, of which the crystalline-schist formation is supposed to be the survival, the author plunges at once into the subject of metamorphism, which he takes up and treats with the same thoroughness as is evinced in the first two volumes of his work. The principal topic of the portion of the volume before us is the description of metamorphic phenomena, under which are described the action of lightning on rocks, the products of the action of coal burning underground (Erdbrände), and the changes produced in rocks by the intrusion through them of eruptives (contact-action). Under contact-action are treated the effect of igneous rocks upon coals, their effect upon inclusions caught up in them during their progress to the surface, and the result of their action upon eruptive and sedimentary rocks through which they break.

[1] Allgemeine und Chemische Geologie. 3 B. 1 Abt. Hertz (Besser'sche Buchhandlung), Berlin, 1890, 210 pp.

The effects upon inclusions of various kinds are discussed in detail, first coming quartz inclusions, then following in order inclusions of old eruptive rocks and crystalline-schists, inclusions of younger eruptives, inclusions of clastic rocks, of sandstone, of quartzite, of basalt-jasper, and of contact-rocks. Contact-action proper is treated under three heads: first, the action upon intruded eruptives; second, upon crystalline-schists; and third, upon sedimentaries. Endomorphous contact-action is next described, and the articles relative to it are briefly extracted. The action of pressure upon rocks is next taken up, and the discussion of the changes produced in them by gaseous emanatious concludes the portion of the volume under review. Practically all the results bear-upon metamorphism that have been reached by investigators in their study of rocks are incorporated in the book, so that for this reason, if for no other, it becomes indispensable to the working lithologist as well as to the geologists. Many students will be unwilling to share with Dr. Roth his skepticism with regard to the conclusions reached by careful observers in all parts of the world, but none of them can afford to be without the volume on their book-shelves for consultation.

W. S. B.

General Notes.

GEOLOGY AND PALEONTOLOGY.

Discovery of Fish Remains in Ordovician Rocks.—At a meeting of the Biological Society of Washington on February 7th, 1891, Mr. Charles D. Walcott, of the U. S. Geological Survey, announced the discovery of vertebrate life in the Lower Silurian (Ordovician) strata. He stated that "the remains were found in a sandstone resting on the prepaleozoic rocks of the eastern front of the Rocky Mountains, near Cañon City, Colorado. They consist of an immense number of separate plates of placoganoid fishes and many fragments of the calcified covering of the notochord, of a form provisionally referred to the Elasmobranchii. The accompanying invertebrate fauna has the facies of the Trenton fauna of New York and the Mississippi valley. It extends upward into the superjacent limestone, and at an horizon 180 feet above the fish beds. Seventeen out of thirty-three species that have been distinguished are identical with species occurring in the Trenton limestone of Wisconsin and New York.

"Great interest centers about this discovery from the fact that we now have some of the ancestors of the great group of placoderm fishes which appear so suddenly at the close of the Upper Silurian and in the lower portion of the Devonian group. It also carries the vertebrate fauna far back into the Silurian, and indicates that the differentiation between the invertebrate and vertebrate types probably occurred in Cambrian time."

Mr. Walcott is preparing a full description of the stratigraphic section, mode of occurrence and character of the invertebrate and vertebrate faunas, for presentation at the meeting of the Geological Society of America, in August, 1891.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Among the several brochures lately published explanatory of the new map of France, one by Lacroix[2] contains two articles. The first is descriptive of the metamorphic and eruptive rocks of Ariège, and the second is on the acid inclusions in the volcanic rocks of the Auvergne. In the former the marbles of Mercus and Arignac are carefully described. In them occur two varieties of humite, brucite, amphibole, phlogopite, scapolite, spinel, corundum, sphene, rutile, zircon, and many other less common minerals. One variety of the humite occurs in rounded crystals of a clear yellow color, that become colorless in thin section. The other variety is light orange, becoming golden yellow in the section. Both possess the same optical properties, except that the orange crystals are pleochroic in pale yellow and light golden-yellow tints. They are classed by the author with the clino-humites. Their alteration products are interesting. The most usual alteration is into brucite, found either in little plates, often several millimeters in length, or in fibres forming aureoles around unaltered cores of humite. Another alteration is into chrysotile. This is rare, and the change is usually incomplete. A third method of decomposition is into a granular mixture of secondary calcite, dolomite, and small grains of the original mineral. The amphibole in the rocks is pargasite. Two varieties of spinel were observed, one a violet and often transparent variety, and the other green pleonast. The violet spinel often accompanies the pargasite and humite. Both spinels are almost always surrounded by a circle of colorless chlorite in thin plates, and this in turn by a zone of secondary calcite and an outer rim of brucite. The rutile merits special attention, because what appears to be the ordinary black variety is found in thin section to be sometimes this, and sometimes like the violet rutile of the amphibole and pyroxene gneisses of Norway. The pyroxene and amphibole gneisses of this region and the wernerite gneisses present few peculiarities. The marbles, pyroxene gneisses, and granulites of St. Barthélemy are all marked by interesting features. The accessory components of the marbles are almost exclusively graphite, scapolite, pyroxene, and occasionally oligoclase, the last three forming rounded grains rarely surpassing a millimeter and a half in diameter.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. des Serv. d. l. Carte. gèol. d. France, No. 11, T. II.

The peridotite contains hypersthene and amphibole. Its olivine is perfectly fresh, and is in irregular grains imbedded in the amphiboloids. Some of the granulites contain corroded crystals of bright red andalusite, and also black tourmaline, sphene, muscovite, and garnet disseminated in a ground-mass of feldspar and quartz. Other granulites are very rich in cordierite, and these are in general less rich in quartz than are those bearing andalusite. Micaceous and quartzitic schists from the neighborhood of Ax embrace zircon, apatite, sphene, magnetite, and numerous other materials, thought to be due to the action of the granulite on the schists. On the granulite side of the contact this rock is found to be charged with andalusite, and often with cordierite. Pyroxenites consist of a colorless diopside, zoisite, garnet, calcite, occasionally quartz, and frequently vesuvianite, of which latter it is possible to isolate beautiful amber-yellow crystals of the variety egeran. In the second article by the same author is a discussion of the changes effected in acid inclusions by the basaltic and acid rocks of Auvergne. Two classes of these inclusions are recognized, viz., those found in lava streams, and those occurring in volcanic necks. Both classes include granites and gneisses rich in quartz, and frequently containing cordierite, sillimanite, garnet, corundum, diaspore, and zircon The changes effected in them by the basic lavas varies in intensity, but not materially in kind. In extreme cases the inclusion has been entirely dissolved, with the exception of the insoluble substances, such as sillimanite, zircon, and diaspore, which remain as grains in the volcanic glass. The cleavages of the original feldspars have been accentuated, many liquid and gaseous inclosures have been developed in them, and the optical properties of the orthoclase have been changed. Quartz fragments in the altered forms have been surrounded by aureoles of augite. The new minerals developed in the surrounding rock by the solution of the inclusion are spinel, hypersthene, and sometimes labradorite, sometimes forming holocrystalline aggregates, and at other times occurring as individual grains bathed in a vitreous paste. In each case the minerals are met with only in the lava that has been injected between the components of the inclusions. They are not present in the magma enclosing them. The inclusions in the andesites and trachytes of the region are gneisses and kersantites. In most respects the changes that have been produced in them are analogous to those produced by the basalts. Much new feldspar has been generated in them, and this is usually optically continuous with the original feldspar to which it is attached. Tridymite is also an abundant new product, as are also spinel and hypersthene. All these minerals are

produced in the inclusion; whereas in the case of the basaltic alteration the last two are found in the metamorphosed rock. In a later article Lacroix[3] summarizes the results of his study of inclusions, with reference especially to those of the Haute-Loire. When the inclusions are of the same composition as the enclosing rock, the former have in general been well preserved. If, on the contrary, the inclusion differs in its silica content from the surrounding rock, it is easily destroyed, merely traces of it remaining to mark its former presence.——Graywacke in contact with granite in the Lausitz, Saxony, is changed to knotty (Knoten) graywackes, in which muscovite, biotite, quartz, feldspar, and tourmaline occur as new products, and finally into a quartz-mica rock with cordierite, tourmaline, and some other new products. On the granitic side the rock has assumed a gneissic aspect, thought by Herrimann and Weber[4] to be the result of flowage.——The micro structure of several calcareous oölites from Iowa, and of siliceous oölites from Pennsylvania, is represented by Messrs. Barbour and Torrey[5] as concretionary in most cases, while in others the spherules have a brecciated or mosaic appearance. Analyses of several kinds of oölites are given in the paper.

New Minerals.—*Castanite*, associated with barite occurs on a copiapite specimen from Sierra Gordo, Chili, in the form of large, brown, prismatic crystals, without well-developed faces. According to Darapsky[6] their streak is orange, hardness 3, and density 2.18. They are but slightly soluble in water or in cold hydrochloric acid, but easily dissolve in hot acid. Their composition ($SO_3 = 33.80$; $Fe_2O_3 = 33.92$; $H_2O = 30.76$; barite $= 1.15$) corresponds to $Fe\,(FeO)(SO_4)_2 + 8\,H_2O$. The crystallization is probably monoclinic.——*Manganopectolite* is associated with ozarkite and other decomposition products of elæolite-syenite at Magnet Cove, Ark.[7] On a fresh fracture the mineral is light gray and transparent. On its exterior it is covered with an opaque coating of brown manganese oxide. The crystals are bounded by oP, $\infty\bar{P}\infty$, $+\ 2\bar{P}\infty$ and $\infty\bar{P}\infty$, and their axial ratio is $a : b : c =$ 1.0731 : 1 : 4840. Their habit is thick tabular. Cleavage is perfect, parallel to oP and $\infty\bar{P}\infty$. Hardness $= 5$, and density 2.845. Composition :

SiO_2	Fe_2O_3	CaO	MnO	Na_2O	H_2O	CO_2
53.03	.10	30.28	4.25	8.99	2.43	.82

[3] Bull. Soc. Franç. d. Min., XIII., 1890, p. 100.
[4] *Neues Jahrb. f. Min.*, etc., 1890, II., p. 187.
[5] *Amer. Jour. Sci.*, Sept., 1890, p. 246.
[6] *Neues Jahrb. f. Min.*, etc., 1890, II., p. 267.
[7] J. F. Williams. *Zeits. f. Kryst.*, XVII., 1890, p. 386.

Correcting for the small amount of calcite present, the analysis corresponds with the formula $(\frac{9}{10}\,Ca, \frac{1}{10}\,Mn)_2\,Na\,H\,(SiO_3)_3$—a pectolite with a tenth of its calcium replaced by manganese. In its optical properties the new mineral agrees well with the view that it is closely allied to pectolite. Its axial plane is $\infty P \infty$, with b the acute bisectrix. The double refraction is positive, and the dispersion is strong $\varrho > \rho$.——*Pinakiolite* and *trimerite* are both new minerals from the Manganese Mines in Sweden. The name of the first refers to its occurrence in small, tabular crystals. It was found by Flink[8] in granular dolomite at Langbanshyttan, associated with hausmannite. The density of the new mineral is 3.881, and its hardness is 6. It is soluble in strong hydrochloric acid with evolution of chlorine, and before the blowpipe it fuses with difficulty to a black bead. An analysis of the hydrochloric acid solution yielded :

B_2O_3	MgO	Mn_3O_4	Fe_3O_4	CaO	PbO	SiO_2	H_2O
15.65	28.58	49.39	2.07	1.09	.76	1.21	.47

Correcting for silica and water, the formula becomes R_2BMnO_5, or a manganese *ludwigite*. The black, lustrous crystals are usually orthorhombic, rectangular tables, in which the brachypinacoid is most developed. In addition to this there is present in the mineral only $\infty \bar{P} 3$. A definite termination of the c axis is lacking, but since twins with a brachydome as a twinning plane are common, the axial ratio was calculated with this as the unit form, and the following result obtained : $a : b : c = .83385 : 1 : .58807$. Cleavage is parallel to $\infty \breve{P} \infty$. The optical axial plane is oP, with b the negative acute bisectrix. The absorption is $B > A > C$, with $B = c =$ opaque ; $A = b =$ reddish-brown, and $C = a =$ reddish-yellow. *Trimerite* (τριμερής = three-fold) was found at the Harstigsgrube associated with frïedelite implanted on a fine-grained aggregate of magnetite, pyroxene, garnet, etc. The density = 3.474, and hardness = 6–7. The pulverized mineral dissolves in hot hydrochloric acid, with the separation of gelatinous silica. Its composition :

SiO_2	BeO	MnO	FeO	CaO	MgO
39.77	17.08	26.86	3.87	12.44	.61

corresponds to $(MnBe)SiO_4$, a manganese *phenacite*. The transparent bright red crystals have an hexagonal habit, due to twinning of triclinic individuals, whose triclinic nature is discoverable only by optical methods. In order to show their relations to the Willemite

[8] *Zeits. f. Kryst.*, XVIII., 1890, p. 361.

group the author describes the crystals in terms of the hexagonal system with $a : c = 1 : .7233$. They are thick, tabular forms, bounded by $0P$, ${}_{\infty}P2$, ${}_{\infty}P$, $\frac{3}{2}P2$, $\frac{3}{4}P2$ and $\frac{15}{8}P\frac{5}{4}$, and other pyramids with complicated symbols. Brögger finds that sections parallel to ${}_{\infty}P2$ extinguish at about 4° from *c*. $2V = 83° 29'$, with a very slight dispersion. The angles α, β and γ are all nearly 90°, so that the combination is somewhat similar to the combination of orthorhombic aragonites to produce an apparently hexagonal form. The axial ratio on the assumption of triclinic symmetry becomes $a : b : c = .5744 : 1 : .5425$, and the forms $0P$, $\infty\bar{P}\infty$, ∞P^{1}, $\infty{}^{1}P$, P^{1}, ${}^{1}P$, P_{1}, ${}_{1}P$, $\frac{3}{2}\bar{P}^{1}3$, $\frac{3}{2}\bar{P}_{1}3$.

Mineral Syntheses.—Boracite has been produced by Gramont[9] in the wet way. One part of borax and two of magnesium chloride were moistened with water and heated to 275°–280° in a sealed tube. Little crystals of the mineral thus obtained are bounded by tetrahedrons, octahedrons, and other forms apparently belonging to the regular system. Each tetrahedral face, however, is observed, upon examination, to be composed of small sectors, indicating a grouping of individuals of lower symmetry to produce a pseudo-regular form. When the mixture was heated at a temperature below 265° (the temperature at which natural boracite becomes isotropic) no boracite was obtained, but in its stead there resulted elongated hexagonal crystals of some substance not yet investigated.——One part of alumina and two of silica, according to Vernadsky,[10] unite at a white heat to form a glass which, under the microscope, is seen to be filled with little needles of sillimanite, with the composition : $SiO_2 = 37.31$; $Al_2O_3 = 63.65$. Porcelaine consists essentially of the same substances, viz., a glass holding acicular crystals of sillimanite.——Many of the most important zeolites have been manufactured by Doelter,[11] who at the same time has solved some of the problems as to their composition. His method of procedure was to dissolve suitable substances at moderately high temperatures under pressure, and allow them to cool gradually and crystallize. In this way he succeeded in making apophyllite, chabazite, heulandite, natrolite, and skolecite. The author next proceeded to investigate the composition of the minerals formed by heating some specimens to a temperature beyond which they lose water, occasionally examining them chemically and optically, and by fusing others and studying their decomposition products. At 260° apophyllite loses 19 per cent. of its

[9] Bull. Soc. Franç. d. Min., XIII., 1890, p. 252.

[10] Ib., p. 256.

[11] *Neues Jahrb. f. Min.*, etc., I., 1890, p. 118.

water, and above this temperature is decomposed. Just below 260° the hydrate is biaxial, while above this temperature the anhydrous residue is uniaxial. Other zeolites yield similar results. These lead to the conclusion that they all consist of a nepheline, pyroxene, or feldspar-like silicate, combined with meta- or orthosilicic acid, and also an amount of water varying with the temperature. The crystal water may be driven off at high temperature, and taken up again at a lower one, and the various hydrates obtained by the successive steps may possess different crystallographic properties. After a certain amount of loss the minerals refuse to part with more water, which is regarded as chemically combined with silica in the silicic-acid portion of the combination. The author determines incidentally the solubility of several of the zeolites in different solvents, and concludes his paper with a table giving the supposed composition of the members of the group. Heulandite is represented as $CaAl_2Si_4O_{12}+2H_2SiO_3+3Aq$; natrolite as $Na_2Al_2Si_2O_8+H_4SiO_4$, etc.——Messrs. C. and G. Friedel,[12] by the action of lime on mica in the presence of calcium chloride, obtained small crystals of anorthite, and by the action of soda and sodium sulphate on the same mineral produced little prismatic crystals of a substance differing from nosean in the addition of two molecules of water.[13]

Physical Mineralogy.—The discussion as to the cause of optical anomalies in uniaxial crystals has received another addition in a late article contributed by Martin,[14] in which the writer attempts to show that the Mallard theory with respect to these phenomena is faulty. Mallard believes that the crystals are pseudo-uniaxial; that they consist of several twinned individuals, which by their combination build up a form possessing a geometrical symmetry of higher grade than that belonging to its individual constituents. Martin has examined several organic compounds, and is thereby led to the conclusion that in these the anomalies are due to strain or pressure exerted on some parts of the crystal by the more rapid growth of other parts. It is well known that in many crystals a skeleton is formed first in the act of crystallization, and that this skeleton is subsequently filled in by the deposition of material within its arms. The skeleton thus grows faster than the interstitial substance, and exerts in this latter a strain whose effect is exhibited in the anomalies. Other important thoughts are brought out in the investigation, which appears to have been conducted in a

[12] Bull. Soc. Franc. d. Min., XIII., 1890, p. 233.
[13] Ib., p. 238.
[14] *Neues Jahrb. f. Min.*, etc., B.B. VII., p. 1.

careful and conscientious manner.——Wyrouboff,[15] in a reply to Martin's article, states that the latter's results differ but little from his own, and that the conclusions reached by him comprehend no new notions. ——The writer last referred to (W.) has recently[16] completed a series of experiments on circularly polarizing substances, by which he seems to have shown that the peculiar property of these bodies is due to their structure, which is described by Mallard as an irregular piling of very small biaxial plates. In this way a high grade of symmetry is imitated, while the plates are really of a low grade. He also adds a nineteenth substance to the list of rotatory polarizing bodies, viz., $(NH_4)LiSO_4$, which is apparently biaxial and positive.——The effect of temperature upon the optical and crystallographic constants of prismatic sulphur has been thorougly investigated by Schrauf,[17] who records his results in an excellent paper of fifty-nine pages. The first part discusses the values of the interfacial angles at different temperatures. The second is confined to refractive phenomena, such as the refractive index for different wave lengths. The third and fourth contain calculations of the values of the optical constants, and the fifth contains a discussion of the relations existing between the refractive indices and the wave length of the transmitted light, temperature, and other factors, and concludes with remarks on the constancy of the refractive and dispersive power, and upon the crystal form of prismatic sulphur.——A paper by Becke[18] on the etching of fluorite is a remarkable exhibit of careful and painstaking work in this branch of physical mineralogy. The author has subjected both natural and prepared faces of crystals from various localities to the action of acids and alkalies of various strengths and at different temperatures, and has studied the results produced. The symmetry of the figures obtained indicate a tetragonal symmetry for the mineral. Anomalous figures on some crystals, found only on planes that show double refraction, are explained as due to the manner of growth. Many new ideas are gathered from the study, one of the most important of which is embodied in a restatement of the law of symmetry of etched figures. These possess the symmetry of the face on which they occur only when this is a natural one free from striations, vicinal planes, etc. Experiments on the solubility of the mineral in different directions lead to the expression of a law of solubility as follows: The rapidity of solubility is equal along equivalent crystallo-

[15] Bull. Soc. Franc. d. Min., XIII., 1890, p. 94.

[16] Ib., p. 215.

[17] *Zeits. f. Kryst.*, XVIII., 1890, p. 114.

[18] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 349

graphic directions, and different along unequivalent directions. Further, the author finds that elevations due to etching (aetzhügel) occur on faces least capable of resisting solution, while depressions (aetzgrübchen) are produced in the least soluble faces. Etching zones, he defines as those containing the planes with the greatest capacity for resisting solution. Many more results of interest are contained in the paper, the character of which is sufficiently indicated by the conclusions above referred to.——The natural etched figures on the topaz of San Louis Potosi, Mexico, correspond in symmetry with the faces on which they occur, with the exception of those on the brachypinacoid $2P\breve{\infty}$, which are unsymmetrical. According to Pelikan [19] they resemble the figures produced by Baumhauer upon treating the mineral with molten potassa.——Dufet [20] obtains 1.54421 as the value of the refractive index of quartz, based on the examination of seventeen different specimens of the mineral.

Miscellaneous.—The cosmic dust (kryokonite) collected by Nordenskjöld in Greenland, in 1883, has been submitted to Wülfing [21] for investigation, by whom it has been found to consist in greater part of feldspar, quartz, mica, and hornblende. There are present in it also garnet, zircon, magnetite, augite, and sillimanite, and with them is mixed a nitrogenous organic substance. The most interesting constituents of the dust are little chondri of opaque, isotropic transparent, and double refractive material. The larger part of the dust is thought to be a sediment from the air, and to have been obtained by it from a region of crystalline schists. The chondri, on the other hand, are thought to be of cosmic origin, since they are similar to the chondri obtained in deep-sea soundings. If the amount of the dust collected from the snow in Greenland represents the fall of one year, the total amount falling upon the entire surface of the earth in this time is 125 million kilograms, equivalent to a cube of thirty-one yards on a side.——A new crystal refractometer has been devised by Czapski.[22] Its construction and use is carefully described by the inventor in a recent paper in the *Neues Jahrbuch.*——That a definite relation exists between the habits of crystals of certain minerals and their mode of formation has long been recognized, but it has been left for Arzruni [23] to undertake a systematic study of this relation. In a

[19] Ib., XI., 1890, p. 331.
[20] Bull. Soc. Franc. d. Min., XIII., 1890, p. 271.
[21] *Neues Jahrb. f. Min.*, etc., B. B., VII., p. 152.
[22] *Neues Jahrb. f. Min.*, etc., B. B., VII., p. 175.
[23] *Zeits. f. Kryst.*, XVIII., 1890, p. 44.

late paper this writer communicates the results of the examination of crystals of hematite produced by sublimation in smelting furnaces and those from San Sebastiano, Italy, that are supposed to have been formed in an analogous manner. In all of these the habit is the same, although different combinations of nearly related forms occur on them. Sublimed valentinite and senarmontite are likewise studied. Cuprite produced by slow oxidation at a low temperature has an octahedral or dodecahedral habit, while that produced at a high temperature is probably hexahedral. Struvite obtained from a solution of Koch's peptone differs materially from the natural mineral, but the differences have not yet been carefully enough studied to warrant any general conclusion being drawn from the observations. Further articles from Prof. Arzruni will be looked for with interest.

BOTANY.

The Relative Altitudes of the Rocky and Appalachian Mountain Systems as Influencing the Distribution of Northern Plants.—In the study of the geographical distribution of North American plants certain difficulties have been apparent since the adoption of three "regions," extending north and south, and denominated respectively the eastern, central, and western. A much better division of the continent is that proposed by Britton,[1] who recognizes a northern region, including British America, the Sierras, the Rockies, and the Alleghenies; and a southern region, including the Atlantic coast, Mississippi valley, and a part of California. Not only does such an arrangement of regions make it possible to group more correctly the known facts of spermaphytic distribution, but, to a certain extent, it corresponds more exactly with the probable method of original distribution of all plants over the continental area of North America. Since the glacial period the great drift-covered tracts have been covered with vegetation, spreading slowly from Siberia and Scandinavia on the north, and from Mexico and South America on the south. The flora of North America, then, exclusive of Mexico, is, for the most part, a resultant of the greater or less commingling of these two currents of vegetation, the one flowing constantly to the south, the other as constantly flowing northward.

[1] The General Distribution of North American Plants; by N. S. Britton. Meeting of the American Association for the Advancement of Science. 1890.

That a group of plants developed most abundantly in high northern latitudes should extend southward along north and south mountain ranges is precisely what one would expect, for in such localities conditions resembling the normal would be obtained. Consequently a large number of distinctively boreal plants may be found on the tops of high tropical mountains. With this well-known fact of distribution in mind, it will be plain that one should expect a high mountain range to bring south a greater number of northern plants than could be brought by a low mountain range. Such a hypothesis would find some support, at least, if one considers the distribution of Canadian spermaphytic genera in the southwestern United States, and then in the southeastern. Of the two great mountain systems of North America, the western is much higher and extends farther to the south. Throughout Colorado the elevation of Rocky Mountain peaks is somewhat over 13,000 feet, while the highest peak of the Alleghenies is barely 8,000 feet, above sea-level. The Rocky Mountain range from Montana to New Mexico averages about twice the height of the Appalachian chain from New York to the Carolinas.

The accompanying table is compiled to exhibit what seems to be the clearly preponderant massing of typically northern plants southwest rather than southeast. In the compilation only the more compendious lists have been employed. These are those of Macoun, Watson, Coulter, Chapman, Gray, and Porter. The table shows the number of species and varieties of several distinctively northern and south-bound genera in Canada, in the southern Colorado and New Mexico regions, and in the southern Appalachian regions, respectively. For the most part, genera which have their greatest North American development in British America are the ones which have been selected. In the majority of cases, too, the genera chosen are those of wide range, east and west, in the Canadian region. It is possible that the figures are not exactly accurate for many of the entries, since only a little critical work on the nomenclature has been attempted, and some synonyms may have crept into the totals. Again, especially in the southwestern region, some entries should doubtless be made from the smaller plant lists, not given by the larger lists, which alone were employed. This source of error, as will be seen, would not at all tend to vitiate the general results.

A Table Showing the Relative Distribution Southwestward and Southeastward of Certain Distinctively Boreal Genera of North American Spermaphytes:

	Canada.	Southern Rocky Mts.	Southern Alleghenies.		Canada.	Southern Rocky Mts.	Southern Alleghenies.
Anemone,	14	5–6	3	Potentilla,	45	28	3
Ranunculus,	41	24	14	Rosa,	19	6	4
Caltha,	5	1	1	Saxifraga,	38	17	5
Aquilegia,	5	7	1	Mitella,	5	2	1
Delphinium,	5	5	3	Huchera,	7	6	5
Nymphæa L.,	4	2	2	Parnassia,	5	3	2
Cardamine,	10	5	3	Epilobium,	17	8	3
Draba,	26	14	5	Peucedanum,	9	4	0
Arabis,	15	8	6	Lonicera,	12	3	3
Lepidium,	7	4	1	Galium,	17	8	7
Sisymbrium,	12	4	3	Valeriana,	6	3	2
Nasturtium,	8	5	3	Campanula,	10	4	4
Viola,	31	11	16	Vaccinium,	22	5	10
Silene,	11	6	6	Bryanthus,	5	1	0
Lychnis,	11	3	0	Kalmia,	4	1	4
Arenaria,	20	17	2	Ledum,	4	0	0
Stellaria,	18	8	4	Pyrola,	14	7	1
Cerastium,	12	4	4	Primula,	9	3	0
Sagina,	5	3	1	Gentiana,	29	15	7
Claytonia,	13	5	2	Veronica,	15	5	4
Geranium,	9	7	2	Castilleja,	6	9	1
Oxalis,	4	3	3	Plantago,	17	6	4-5
Lupinus,	16	11	3	Betula,	9	2	3
Trifolium,	20	10	6	Alnus,	5	3	2
Vicia,	8–9	5	4	Salix,	62	18–19	6–8
Spiræa,	8	3	2	Populus,	7	4	3
Dalibarda L.	22	6	6	Habenaria,	22	4	2
Geum,	11	6	3	Cypripedium,	8	2	4
Fragaria,	4	3	1	Unifolium,	7	3	2

In glancing over this table it will be seen that such larger and more widely distributed genera as Ranunculus, Draba, Stellaria, Lupinus, Potentilla, Saxifraga, Epilobium, Pyrola, Plantago, and Salix are very clearly extended southwestward much more abundantly than

southeastward. The same is true, less noticeably, of the smaller genera. Marked exceptions, however, will be noted in the genera Viola, Vaccinium, and Kalmia. These are all northern genera, and their anomalous distribution demands explanation. Of Viola it might be said with reason that many of the species have entered from the east rather than from the west. It is a cosmopolitan genus at the present day, and may have entered the continent by other paths than the ordinary passage across Bering Strait. In Europe, according to Nyman,[1] there are fifty-six species of Viola, while in the Russian Empire, according to Ledebour[2] there are but forty. This would indicate an eastern expansion in North America, corresponding with the westward expansion in the old world. At any rate, the present diffused condition of Viola species makes the problem of the general distribution much more complicated than it might at first appear. The genus Viola, then, although probably northern in point of origin, has been redistributed from southern stations, it may be, and the position of species over continental areas is due to a more complicated interaction of causes than the present writer is able to explain. With reference to Vaccinium and Kalmia, however, no such argument can be employed. Of Vaccinium there are but ten species in the Russian Empire and but three in Europe. The genus is seen, therefore, to center in North America. Kalmia is a North American genus, one species ranging to Cuba, but none found native in the Eastern Hemisphere. Both of these genera, then, are somewhat differently situated from Pyrola, which, although centering in British America, has five species in Europe and five in the Russian Empire. Kalmia and Vaccinium, being typically North American, may have originated far eastward on the continent, and this would give an explanation of the greater distribution southeastward than southwestward. It is a fact that even the Canadian species of these two genera are principally in the eastern provinces. Only one species and one variety of Kalmia range west of Hudson Bay, and fifteen of the twenty-two species and varieties of Vaccinium range in the eastern provinces. A similar state of affairs on the west may be noted in the genera Arenaria and Peucedanum. Both of these are massed upon the western plateau-regions of the continent.

By adding up the column which shows the southeastern extension it will be found that the total is just about half of that obtained by adding up the column which shows the southwestward extension ; that is, twice as many species of northern genera come south along the Rocky

[1] Conspectus Floræ Europeæ.

[2] Flora Rossica.

Mountains as along the Appalachians. This would seem to indicate very strongly a law of distribution such as noted above. It is quite probable that an exactly similar line of tabulation would be offered by the southern and northbound genera, notably those of the Compositæ, if traced up a slow-flowing river like the Mississippi on the one hand, and a more rapid river like the Rio Grande or Colorado on the other. We should expect to find at similar degrees of latitude a preponderance of southern species along the slower river. At any rate, it is comparatively clear that some sort of a proportion may be assumed between the heights of two north-and-south mountain systems, and the number of species of northern genera in the more southern extensions of each range.—CONWAY MACMILLAN.

An Important Work on the Fungi.—North American botanists already owe much to J. B. Ellis and B. M. Everhart for the excellent work they have done in the preparation of the great collection of specimens, the "North American Fungi." They are now about to deepen this obligation by the publication of a volume to be devoted to the systematic description of the North American Pyrenomycetes. The volume will be illustrated by many full-page plates, giving the external or gross anatomy, together with the internal microscopical structure. A personal inspection of many of these plates warrants us in saying that this feature of the work will prove of inestimable value to the student of the fungi. Winter's system of classification will be followed in the text. The volume will contain about five hundred pages, and may be expected some time during the year.

Ringing Trees.—Hartig gives the following account of his experiments in ringing the bark from trees. Trees from which a ring of bark has been taken are affected differently, according to the kind of tree and the thickness of the trunks. Some die rapidly, while others remain alive a long time. The author has already expressed his opinion that most likely root-structure has considerable influence on plants submitted to this operation, and any prognostications as to the probable effects must be guided by the fusions or inosculations which may have taken place between the roots of the tree under treatment and those of the untouched trees around. If the roots, after the cessation of nourishment and of growth, and the formation of new rootlets, soon lose the faculty of absorbing water and the mineral substances from the soil, the death of the plant must be the direct consequence of the operation, unless there are underground unions with the roots of neighboring trees by which life is sustained until the dead

part of the trunk becomes impermeable to water. But if the roots do not entirely lose the power of absorbing water, even in their oldest parts, as in the case of maples, lime trees, etc., the trees continue to thrive without underground union, so long as the denuded trunk is in a fit state to allow of the passage of water. The following interesting example will therefore be easily understood: A spruce fir tree, a hundred years old, divided at a height of about twenty-three feet from the ground into two almost equal trunks. In 1871 a complete ring of bark was removed from one of these trunks. The tree was cut down in the winter of 1888–'89; the two crowns were quite green, that of the ringed side being rather less abundantly provided with leaves. The roots of the injured side had ceased to grow; but in spite of that the ringed branch continued to grow for seventeen years, nourished by the roots of the uninjured side.—*Gard. Chron., from Ann. Agronomiques.*

Botanical News.—The "Index to North American Mycological Literature," in the *Journal of Mycology*, will prove a most valuable aid to students of the fungi. In the last number no less than ninety-eight titles are given for the three months of May, June, and July. Although many of these papers were of slight importance, yet their number indicates a good deal of activity among the workers in this country.——Hereafter the *Journal of Mycology* will appear at least four times a year, but not at regular intervals, the intention being to issue it whenever there is sufficient material for a number.——The elevation of the section of Vegetable Pathology to the rank of a division, thereby placing it on an equal footing with the other branches of the department, is a most gratifying indication of progress in botanical science in the National Capital.——The November number of the *Torrey Bulletin* enumerates sixty-two papers in the excellent "Index to Recent American Literature." At this rate (which is not unusual) the whole number of papers on botany published in America in a year must now be somewhat more than seven hundred! Surely "of making many books (botanical ones) there is no end," and the "much study" required by them will most assuredly prove "a weariness of the flesh." ——Dr. Britton's "List of State and Local Floras of the United States and British America" contains nearly eight hundred entries. Every state and territory has had one or more catalogues made of some portion of its plants. Naturally the older states have more such lists than the newer ones; but some new states have been more favored than some old ones. Thus, while Minnesota has 21, Kansas 30, and Colorado 15, Virginia, Georgia, and Alabama have but four each, and some others have still fewer.——Theodore Holm, of the United States

National Museum, publishes in the proceedings of that institution a suggestive paper on the leaves of Liriodendron, being a study of the leaf-forms observed on individual trees. Thirty-eight figures make it plain that there is very much variation in form in the leaves of this species, and suggest that many of the so-called species based upon the forms of fossil leaves may have little real foundation. Certainly there are as marked differences between some of the leaf-forms figured by Mr. Holm as there are between those often regardad as species by paleobotanists——Two "garden scholarships" will be awarded by the director of the Missouri Botanical Garden prior to the first of April next. These are open to young men not more than twenty years of age, and will entitle the recipients to instruction in practical horticulture and the allied subjects, as well as a sum of money sufficient to cover all expenses of living. The conditions under which these may be obtained may be learned by addressing the Director at St. Louis. ——The October *Botanical Gazette* contains a portrait of J. B. Ellis, the well-known mycologist.——In the October number of the *Revue Generale de Botanique,* Henri Jumelle publishes an interesting paper on the influence of anesthetics on the transpiration of plants. By an ingenious apparatus plants were subjected to the fumes of ether, when it was found that although assimilation was stopped, the transpiration of water was greatly increased.——Part V. of Macoun's Catalogue of Canadian Plants has just come to hand. It is devoted to the Acrogens, and a long list of "additions and corrections" to the preceding parts. Thirteen species of Equisetum are enumerated, sixty-four species of ferns and adder-tongues, and twenty-two Lycopods and their allies. This part completes volume II. of the catalogue. In part VI., which will begin a new volume, we are promised the Characeæ, Musci, and Hepaticæ.——In a recent number (January, 1891) of the *Pharmaceutische Rundschau* Dr. Power and Mr. Cambier give the results of their chemical examination of two "Loco-Weeds," viz.: *Astragalus mollissimus* Torrey, and *Crotalaria sagittalis* L.——A recent number of the *Gardeners' Chronicle* contains figures of the fungus *Glœosporium lœticolor* which causes the "Spot" on grapes in England.

ZOOLOGY.

New California Fishes.—PERKINSIA (genus nov.,) CLUPEIDÆ. Type: ***Perkinsia othonops.***—Like Etrumeus, except that the pectoral and ventral fins are shielded, the scales of the breast adherent forming a ventral buckler, which covers the closed pectoral fins, leaving only the dorsal edge and the extreme tip of the fins visible. The closed ventral fins likewise slip under a posterior buckler. The capillary scales are large, that of the pectoral extending very nearly to its tip, while the ventral axillary scale reaches slightly farther than its fin. Caudal deeply forked, the lateral scales extending continuously upon the center of the fin almost to margin of central rays. Adipose eyelid covering the eye wholly, without a pupillary slit.

Perkinsia othonops; one specimen, 320 mm. long. The single specimen known was caught November 20th, 1890, off Point Loma, by fishermen taking mackerel. It belongs to the British Museum.

Form of *Clupea sagax*, or of a mackerel with a stout tail.

Head 4 ($4\frac{1}{8}$); depth 5 (6); D. 17; A. 10; P. 15; V. 8.; Scales 50.

Head compressed forward, eye longer than snout, 3 in head. Interorbital a little less than snout, $4\frac{1}{2}$ in head, the frontals narrowing forward. Occiput with ridges forming a W, the top of the head with a long, lanceolate depressed area anteriorly, with a median ridge, and a triangular area between anterior part of the W. This region filled with adipose tissue in life. Maxillary 3 in head, not reaching the pupil, the supplemental bone very narrow, the maxillary sublinear, deeply ground. Cheeks opercle, preopercle, lateral portions of occiput and an enlarged humeral scale with multifurcate mucous canals, which, especially upon the cheeks, form conspicuous dendritic markings, the canals being unpigmented against closely dotted interspaces.

Isthmus triangular, the gill covers not emarginate below. Scales large, deciduous. Teeth as in Etrumeus. Pseudobranchia large, exposed. Gill rakers long and slender. Form of dorsal fin similar to that of *Clupea sagax*. The insertion of the fin equidistant between tip of snout and end of the anal. Anal small. Caudal with minute scales. Ventrals entirely posterior to the dorsal fin, short, $3\frac{1}{2}$ in the head. Pectoral fins placed very low, $1\frac{3}{8}$ in head.

Silvery below, steel-blue above, checks golden. Dorsal and caudal fins dusky. Ventral fins with a median blackisk blotch anteriorly. Inner surface of pectoral fins chiefly black, the ends of the posterior

rays hyaline. Adipose eyelid transparent in life, preorbital regions translucent; the adipose tissue becoming opaque in spirits.

SEBASTODES GILLII, sp. nov.

Types: Two specimens, 555 and 580 mm. long, taken off Point Loma, November 19th, 1890. Collection of the British Museum.

Related to *S. cos*, *chlorostictus*, and *rhodochloris*.

Head, 3 (3½ to lip of caudal); depth, 3 (3½); D. XIII., 13½; A. III., 7½. Lateral line (pores), 44–45.

Lower jaw projecting and entering the profile without symphyseal knob. Profile nearly straight to origin of dorsal fin, not steep. Snout very broad, blunt. Maxillary reaching posterior edge of pupil, 2 in the head. Mouth very oblique, the premaxillary on a level with superior edge of the pupil. Orbit 1 in snout, 4⅓–4½, in head, a little greater than interorbital. Interorbital concave.

Pre-, supra-, and postocular, occipital, and nuchal spines sharp; the first four very short and broad, the supraocular spine about 2½ in the interorbital. Occipital spines very high and stout; the nuchal spines almost continuous with the occipital.

Opercular and preopercular spines long and strong, the 3 superior preopercular conical, directed backward, the other 2 flat, triangular, downward and backward. Preorbital with a sharp, subconical anterior spine, and terminating posteriorly in a similar but larger spine. Maxillary with a few scales superiorly on its median third. Snout either naked or with a few scattered patches of scales. Mandible naked.

Scales strongly ctenoid; accessory scales very numerous everywhere, especially so on cheeks. Membranes of soft dorsal, and anal with minute scales on basal half of fins. A few scales basally on spinous dorsal.

Vomerine teeth in a V-shaped patch; palatine teeth in short ovate patches. Gill rakers very short, ¼–⅕. Orbital diameter, 9+17–18.

Spinous dorsal low, the highest spine 2⅗–2½ in head; the fin deeply notched, the highest ray about equal to highest spine.

Caudal truncate. Second anal stouter and about as long as third.

Buccal and opercular cavities and peritoneum white, sparsely dotted with black.

Ventral surface light geranium red, shading into scarlet on the tail. Dorsal surface rather closely covered with small bronze, roundish spots, which extend upon the membrane of soft dorsal fins and a few on the first dorsal. Series of confluent bronze spots form radiating streaks or bands on sides of head; one extends from eye to upper angle of gill-opening, one to tip of lower opercular spine which is con-

tinued upon the shoulder as a conspicuous blotch, one to lower angle of opercle, one downward and slightly backward across cheeks ; lower lip and anterior part of maxillary dusky. A few conspicuous spots on base of pectoral.

All the dark markings becoming blackish and persisting in spirits, the radiating streaks of the head especially conspicuous in the alcoholic specimen. A light spot under last dorsal spine ; one on opercular flap.

S. cos.

Mandible, maxillary, and snout, except a median triangular spot, scaly.

Preorbital with a single, flat, downward-directed spine at its posterior angle.

Interorbital deeply concave, grooved medially.

Second preopercular spine directed downward.

Second anal spine 2⅔ in head.

Color-markings having a washed or faded appearance.

A prominent symphyseal knob.

Intermaxillary band of teeth very deep in front, 3 in orbit, projecting beyond the mandible.

Scales of head strongly ciliate, with upturned edges, the breast scales similar.

Palatine band of teeth long, 1⅓ in orbit.

S. gilli.

Mandible entirely naked ; maxillary with a few scales medially.

Preorbital with an anterior and a posterior spine.

Interorbital nearly evenly concave, the median groove shallow.

Upper three preopercular spines directed backward.

Second anal spine 3½ in head.

Peritoneum nearly white.

Color-markings conspicuous.

No symphyseal knob.

Intermaxillary band of teeth shallow in front, 5 in orbit, the lower jaw projecting.

Scales of head slightly ciliate, depressed.

Palatine band of teeth short, 4 in orbit.

GERRES CINEREUS, var. nov.—One specimen, 185 mm. San Diego, California, summer of 1890. Probably taken in the bay. The single specimen collected for us by Mr. Medina, at San Diego, is intermediate between *G. californiensis* and *G. cinereus*.

The caudal fin is slightly longer than the head, while the second anal spine is short, about 3½ in the head.

Ventral fins 1½ in head. Dark punctulations everywhere, except on the ventral surface. No dark lateral bars. Upper portion of spinous dorsal fin blackish. All the fins finely punctate, the pectorals least so. A dark-blue axillary spot.

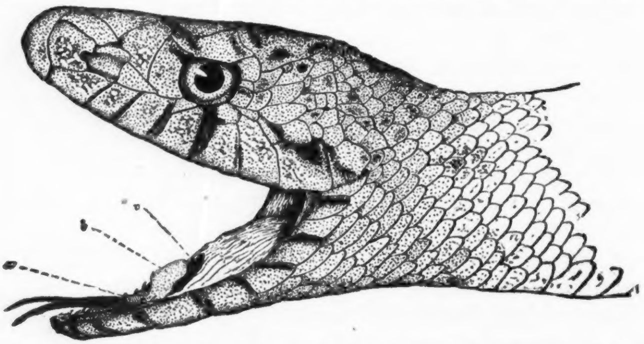
Head, $3\frac{3}{8}$; depth, $2\frac{2}{3}$; scales 6–45–10.

Eye equal to interorbital space, 5 in head. Maxillary just reaching front of eye. Predorsal distance $2\frac{1}{2}$ in the length.

SCOMBRESOX BREVIROSTRIS Peters.—One specimen of this rare species was also collected for us by Mr. Medina in the vicinity of San Diego.

ALOPIAS VULPES (Gmel.).—This shark is also to be added to the fauna of San Diego.—R. S. EIGENMANN, *San Francisco, Cal., Jan. 8th, 1891.*

The Epiglottis in Colubrine Snakes.—In the AMERICAN NATURALIST for January, 1884 (p. 19), Dr. Chas. A. White describes the epiglottis of the pine-snakes (Pityophis), and figures it as it appears in the *P. sayi bellona* B. and G. He shows that instead of having the horizontal form found in the higher Vertebrata, it is a vertical lamina standing erect in front of the *rima glottidis*. He states



Pityophis sayi bellona, B and G, natural size; *a*, sheath of tongue; *b*, epiglottis; *c*, glottidis. From Dr. Shufelot.

that he has found it in all of the species of Pityophis, but that it is wanting in all other serpents which he has examined. As Dr. White does not specify which these species are, I have made an examination of many genera found in all parts of the world, with the view of ascertaining its presence in any of them other than in Pityophis.

The result of my examinations is that it is either distinctly present or absent, and that no intermediate conditions occur. In a few instances an insignificant tubercle occupies its position and represents it as remarked by Dr. White, but this scarcely assumes the importance of a rudiment. I have found it well developed in the four species of Pityophis, and in the two Mexcan snakes which I have enumerated under Spilotes: the *S. deppei* D. and B., and the *S. lineaticollis* Cope

(Bulletin U. S. Nat. Museum, 32, 1887, p. 72). It is, however, wanting in Spilotes proper, and curiously enough in the ***Rhinechis elegans***, which is otherwise a good deal like Pityophis. It is not present in any other American snakes, harmless or venomous. It appears to me to be a character of generic importance, so I propose to separate the two Mexican snakes referred to from Spilotes on account of its presence under the name of Epiglottophis, with *E. deppei* as the type.

Among old-world snakes it is wanting in all types, both venomous and harmless. The rudiment in the form of a small tubercle is present in the *Spilotes helenae, S. melanurus* and *S. samarensis;* also in the *Rhinechis scalaris.*—E. D. Cope.

Notes on the Classification of the Pigeons.—Quite recently the writer has very thoroughly compared the characters presented on the part of the skeletons of specimens of nearly all the genera of the United States Columbidæ. There appears to be a difference of opinion as to how these birds should be classified. Coues, in his "Key" (second edition), states it as his opinion that "the order Columbæ may be separated into three groups or suborders: Didi, Pterocletes, and Peristeræ,—the first two certainly, the last probably, of a single family. The Peristeræ alone are American. These he divides in the following way:

Suborder.	Family.	Subfamilies.
Peristeræ.	Columbidæ.	1. Columbinæ. 2. Zenaidinæ. 3. Starnœnadinæ.

In the Columbinæ he includes the genera Columba and Ectopistes; in the Zenaidinæ, the genera Engyptila, Zenaidura, Zenaida, Melopelia, Columbigallina, Scardafella, and Geotrygon; and finally, in the Starnœnadinæ, the genus Starnœnas.

The American Ornithologists' Union, in its official check-list, presents the order Columbæ to contain the family Columbidæ, and creates no subfamilies for the genera just named above.

Mr. Ridgway, in his "Manual," adopts the same scheme of classification.

Coues primarily bases his division of the Columbidæ into subfamilies upon the following characters:

Tarsi scutellate, feathered . . . . . Columbinæ.
Tarsi scutellate, naked . . . . Zenaidinæ.
Tarsi reticulate, naked . . . . Starnœnadinæ.

The remaining characters, in so far as we have any knowledge of them at present, except in the case of the Starnœnadinæ, do not go to

support this division, and it breaks down utterly when we come to take into consideration the osteology of the various species.

The skeleton of Geotrygon has not been examined by me; but I am of the opinion that it will not militate against the classification suggested below, judging as I do from its external anatomy.

My studies of the osteology of the group convince me that our United States pigeons naturally make a very good suborder, containing the family Columbidæ. Now, if we take the characters presented on the part of the skeleton of such a species as *Ectopistes migratorius*, we find that they are essentially repeated by all the other genera save Starnœnas. When we come to osteologically compare Starnœnas we find that it differs very materially and in a number of points, as in the general pattern of its sternum, the number and arrangement of its vertebræ and ribs, some of its cranial characters, and in the characters of its pelvic limbs.

From osteological premises, then, our family Columbidæ divides naturally into two subfamilies: the Columbinæ, containing the genera Columba, Ectopistes, Engyptila, Zenaidura, Zenaida, Melopelia, Columbigallina, Scardafella, and Geotrygon; and the subfamily Starnœnadinæ, containing the genus Starnœnas.

In another connection it is my intention to present these osteological characters of the Columbidæ in detail.—R. W. SHUFELDT, *Smithsonian Institution, January 22d, 1891.*

Description of Two New Species of Rodents from Mexico.—While recently classifying and arranging the collections of mammals belonging to the Natural History Section of the Comision Geografica-Exploradora of Mexico, I found two species apparently new, whose characters I now give:

SPERMOPHILUS SONORIENSIS, sp. nov.—Apparently quite similar to Dr. Merriam's recently described *S. cryptospilotus*, which I know only from the description. Above, head and body fawn color, with no indications of spots. Individual hairs with extreme bases black, followed by a narrow ring of straw-yellow, subterminally broadly ringed with walnut-brown (which color occupies more than twice the space covered by the two preceding colors), and tipped with cream-buff. Something like one per cent. of the hairs have the walnut-brown replaced by black; but these are so relatively few in number as not to sensibly affect the general tone. Color gradually shading lighter to sides, where it meets, in a sharp line, the white of under parts. A bar of decidedly lighter fawn color, 3 mm. in width, commencing a little

back of the nose, passes between the darker shade of the crown and a superorbital white area, terminating at the ear.

The upper border of the white of under parts is defined by a line drawn from the nostrils, passing over the eyes and through centers of ear openings, across shoulders and along sides of body to the groins. The white area also includes the inner surfaces of legs and dorsal surfaces of hind feet, which latter are slightly washed with rufous. Hairs of under parts entirely white, but so thin in the specimen before me that the color of the skin shows through, giving a plumbeous cast to most of this surface.

Outer surface of fore limb, from elbow to bases of toes, white, more or less washed with rufous. Outer surfaces of hind legs concolor with dorsum.

First third of upper surface of tail the same as back; thence the center is fawn color, bordered by a black zone that, in turn, is bordered by a whitish rufous. On its under surface the black line is scarcely perceptible, the whole of this surface being pale rufous.

Ears, in dried skin, a mere rim.

Lower surfaces of pes densely haired; of manus, naked.

Claws medium sized, black, with white tips; of thumb, as well developed as in *S. mexicanus.*

Mystacial hairs mostly black; a few white ones interspersed.

Measurements of dried skin, in millimeters: Total length, 220; head and body, 155; tail vertebræ, 65; hairs beyond vertebræ, 20; hind foot, 33; fore foot, 21; longest mystacial hairs, 32.

Measurements of skull: Length from point of nasals to upper edge of foramen magnum, 38; greatest width at auditory bullæ, 18; least interorbital width, 9; length of molar series, 8.5; transverse diameter of first premolar, 1.25; the same of second, 2; of first molar, 2.5.

The zygomæ and hinder edge of palate are broken, so as to allow of no measurements being taken from them.

The only noticeable differences between this skull and that of *S. cryptospilotus* (*vide North American Fauna*, No. 3, Pl. IX., Figs. 1, 2, and 3) is that in this the hamular processes of the pterygoids abut against the auditory bullæ posterior to the suture of the basisphenoidum with the basioccipitale, instead of in front of it, as in *cryptospilotus;* and in that the transverse diameter of the first premolar is fully equal to its longitudinal diameter.

Type: No. 517 ♂ ad., Museum of the Comision Geografica-Exploradora de México. Taken by Zenòn Córdova, at Hermosillo, Sonora, November, 1887.

This species belongs to the Spilosoma group, and in all probability finds its closest affinity in *S. cryptospilotus,* from which it appears separable by some slight differences in size, color, and the cranial characters noted.

NEOTOMA TORQUATA, sp. nov.—Above, head and body light Vandyke-brown, washed with black; more intensely in the mesaldorsal line, insensibly becoming entirely obliterated before reaching the white of lower parts. Hairs of all parts, except ears, feet, tail, and a small patch on chin, slate-gray for the greater part of their length. Above ringed for about 3 mm. with Vandyke-brown, followed by a slight tipping of black. In the dorsal line are interspersed longer hairs nearly or completely lacking the rufous ringing, whose place being occupied by the greater extension of the black tips, gives to this part its darker tone, which may be described as hair-brown. Belly nearly pure white, slightly tinged with yellow, and in parts soiled by the slate-gray of roots showing through the white tips of hairs. Breast occupied by a well-defined collar, 20 mm. in width, of same color as sides of body. Under surface of neck grayish-white, gradually shading forward to slate-gray to form an ill-defined band, about 4 mm. in width, that covers the upper lips, excepting a narrow line of white encircling the mouth parts. A small, circular area on chin of pure white, including roots of hairs. Upper third of circumference of tail clove-brown, sharply separated from the dirty white of its sides and under parts. The tail is closely covered with short, stiffish hairs, through which only upon very close scrutiny can the annuli be seen on sides and beneath. Feet white, slightly washed with drab a trifle below carpus and tarsus. Outer surfaces of legs and arms shading from Vandyke-brown above to drab below. Inner surfaces as belly. Ears seal-brown, nearly naked on posterior external surfaces, rather scantily covered with short seal-brown hairs on internal and anterior external surfaces. Mystacial hairs black for half or two-thirds of their length, terminating in white; the longest being 65 mm. Soles of fore feet entirely naked, with five warts; of hind feet, well covered with hair for posterior half, having six warts. Eyes blue-black, very large and exserted. Their diameter in the dried skin is about 8 mm.

Measurements, taken in flesh: Length from tip of nose to end of tail vertebræ, 338 mm. (13.33″); tail vertebræ, 160 (6.37″); manus, 16 (.69″); pes, 35 (1.41″); ear, 21 (.84″).

The skull shows no peculiarities of note. Length, 45; greatest width of zygomæ, 23; length of both upper and lower molar series, 9; length of inferior mandibula from arthral bead to anterior edge of

alveola of incisor, 25. The skull and teeth are nearly precisely as figured by Baird for *Neotoma mexicana* (U. S. Mex. Boundary Survey, Mammals, Pl. XXIV., Figs. 1 *a* to *g*.)

Type specimen: No. 380, Museum of Comision Geografica-Exploradora; adult female, taken between Tetela del Volcan and Zacualpan Amilpas, State of Morelos, Oct. 26, 1890. Collector, H. L. Ward. Found in dark tunnel of an abandoned mine.

According to Coues (Mon. N. A. Rod.), Neotoma is a genus in which cranial and dental characters count for little or nothing (!), but in which color appears to be quite constant. We will therefore disregard the almost exact conformity of the skull and teeth of this species with those figured by Prof. Baird for *mexicana*, and will call attention only to external characters. *N. torquata* is at once distinguished from all known species of Neotoma by its collar; also from *floridana* by the more rufous color of upper parts, and by roots of hairs of belly being gray instead of white; from *fuscipes* and *ferruginea* by this latter distinction and the tail being bicolor, instead of unicolor; from *cinerea* in general coloration and in not having the tail bushily haired.—Henry L. Ward, *Tacubaya, D. F. Mex., Jan. 22, 1891.*

The Entepicondylar Bridge in Man.—M. S. Nicholas, has observed and recorded (*Revue Biologique du Nord de la, France*, 1891, p. 121), six cases of the presence of a rudiment of the superior part of the entepicondylar bridge of the humerus in man. They all occurred in insane persons who died in the Asylum of Maréville. This anomaly is interesting as constituting a lemuroid reversion. Struthers has observed this anomaly in 2 p. c. of skeletons he has examined, and Gruber in 2.7 p. c. Testut gives 1 p. c. as the proportion of cases, which Nicholas thinks is the most probably correct figure.

EMBRYOLOGY.[1]

Development of Mammals.—In so thoroughly worked over and so narrowly bounded a field as vertebrate embryology we should hope to find a singleness of plan running through the series, accompanied by an agreement amongst workers and theorists as to the interpretation of the known phenomena. In fact, however, the greatest possible divergence is found. This is especially marked in the recent attempts of embryologists to explain the process of gastrulation in the groups of vertebrates. Of course the problem of the mesoblast is here, as everywhere, a challenge for battle; but this is not all, for even the origin of endoderm and ectoderm have their various interpreters.

An illustration of this is furnished by the three (and more) hypotheses which are advanced to account for the early stages of development of the mammals. Two of these may be taken here as an example, and a third will be mentioned below in a review of Hubrecht's recent paper. The two which we shall now consider are those of Haddon[2] and Minot.[3] These two theories, advanced about the same time, are said by Haddon to be "somewhat similar hypotheses," and Minot says that his own is "the most satisfactory, and preferable to the similar explanation advanced . . . by Haddon." To an outsider the two theories seem to contradict each other in all that is essential and new to each.

Balfour prophesied that the ancestral mammal had a large ovum filled with yolk, and this, by Caldwell's discovery of the eggs of Monotremes, has been practically demonstrated. Both Haddon and Minot accept this as their starting point, but immediately diverge in opposite directions in their "somewhat similar explanations."

The two accompanying diagrams have been copied to illustrate their views:

Diagram *A* gives Haddon's idea of the meaning of the germ-layers of the mammalian embryo. The central cavity (*y.s.*) is the yolk-sac of the ancestral vertebrate, which has been covered over *precociously* by ectoderm (*e.c.*); ancestrally this was accomplished by epibole. At the upper pole the blastoderm, owing to the loss of yolk, has fallen into the yolk-cavity, leaving a small opening (*B b*) at the

[1] Edited by T. H. Morgan, Johns Hopkins University, Baltimore.

[2] Elements of Embryology.

[3] AMERICAN NATURALIST, April, 1889.

surface, which Van Beneden mistook for the blastopore. The blastoderm proper consists of ectoderm, several cells in thickness, and below scattered endoderm cells. The mesoderm is formed later between the

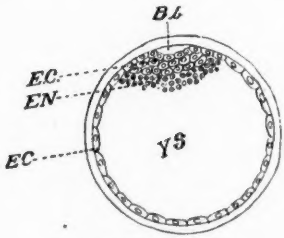


FIG. 1.—(Diagram A.)

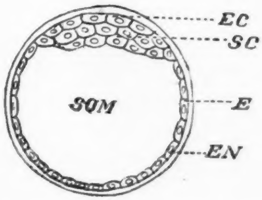


FIG. 2.—(Diagram B.)

two. The strong point of this explanation is that it seems to refer the germ-layers back to a condition found in the reptilian embryo, and the weak point, it seems to me, is that it does not clearly illustrate the method by which the yolk has been lost, and what cells originally contained it.

Minot gives the following hypothetical stage to explain the homologies of the mammalian germ-layers (see Diagram *B*). The large central cavity, which he calls the segmentation cavity (the yolk-cavity of Haddon), is surrounded by *endodermal* cells, which formerly contained yolk. (Hence they do not represent epibolic ectoderm, as believed by Haddon.) The walled blastoderm (embryonic knob) at the upper pole of the figure is composed probably *entirely* of *ectoderm cells*. (Again a contradiction to Haddon's view.) The endoderm which later appears under the blastoderm comes from the sides where the endoderm cells around the segmentation cavity pass into the ectodermal blastoderm. Here, it seems to me, is the weakest part of the hypothesis, and Dr. Minot seems to have expected to find the same formation of endoderm as in the teleost. This is flatly contradicted by well-supported statements. (See Hubrecht below.) The author has jumped from the frog's gastrula to that of the mammal, not giving, I believe, due weight to the intermediate reptilian stage, assuming that with the loss of yolk in the ancestral mammal there was a return to the more primitive condition of the amphibian stage; but it seems this is hardly a fair assumption as a basis for further hypotheses.

Prof. Hubrecht gives a second paper[4] in his studies in mammalian embryology, entitled "The Development of the Germinal Layers of

[4] *Quar. Jour. Micro. Science.*

Sorex vulgaris." The paper is a detailed description of the origin of the germ-layers. The earliest stage obtained had a single layer of flattened cells (ectoderm) lying beneath the zona and bounding a central cavity filled with fluid. These ectodermal cells he calls the trophoblast. At one point in the periphery there is an accumulation of cells —the embryonic knob—which contains the material for the embryonic ectoderm and endoderm. The cavity in the center surrounded by the trophoblast and filled with fluid is the *segmentation cavity.* The embryonic knob gives rise to the early endoderm cells from its more central part, and some of these then migrate around the periphery of the central cavity and apply themselves to the inner side of the trophoblast (ectoderm). See Diagram *C.* (This contradicts part of Minot's hypothesis given above.) The trophoblast cells seem to grow over the embryonic knob, causing an "inversion" of the embryo. After the differentiation of the endoderm from the embryonic knob the remaining ectoderm is spoken of as the embryonic shield (*emb.sh.*) The endoderm first forms part of the notochord and mesoblastic plates. Thus under the anterior end of the embryonic shield the endoderm is spoken of as the protochordal plate (*no.ch'.*) The rest of the notochord differentiates later and in a different way. The mesoderm has not yet appeared, but is now inaugurated by the appearance of the primitive streak. The mesoderm originates from three different points: 1st, from the sides of the protochordal plate (see above); 2nd, from the primitive streak, from which it advances forward between ecto- and endoderm; and 3d, from an annular zone of endoderm lying around and under the periphery of the embryonic shield. The details of this process are shown in a large number of figures.

We may now pass to the theoretical considerations of the gastrulation of mammals. (The process of inversion, or the sinking of the embryo into the cavity of the vesicle, may be left out of account, as it produces no important changes in the germ-layers of the embryo, and may in a general way be compared with the later formation of the amnion.) We have seen in the early differentiation of the endoderm from the embryonic knob that part of the endoderm is formed before the actual process of gastrulation has set in,—that is, before the appearance of the primitive streak. This the author calls precocious segregation, and is an *ontogenetic* phenomenon. Later, when the primitive streak is formed (the coalescing of the lips of the blastopore), new endoderm arises in this region and is added to that already present, and this latter is the phylogenetic endoderm, and alone is to be compared to the Sauropsidan type. The remaining part of the notochord

(also the lateral wings of the mesoderm) is formed from the phylogenetic endoderm, and may be compared to the formation of notochord and mesoblast of Batrachia.

We have sufficient evidence to believe that between the Batrachia and the Mammalia a "phylogenetic link has once existed, in which the actual food-yolk formed a very considerable addition to the early blastocyst. The case of the Ornithodelphia is most important in this respect. . . . When the nutritive contents of the yolk-sac were no longer of primary importance, . . . a reduction in size of the blastocyst was not effectuated because *another factor came into play.* The vascular area which heredity called forth on the surface of the yolk-sac . . . must have rendered eminent service for the establishment of a different mode of nutrition, as soon as the embryo underwent a considerable part of its development inside the maternal generative ducts." Hence the large size of the blastocyst of the mammal has been *retained not because it once contained yolk,* but because it was an essential function to perform in the nutrition of the embryo.

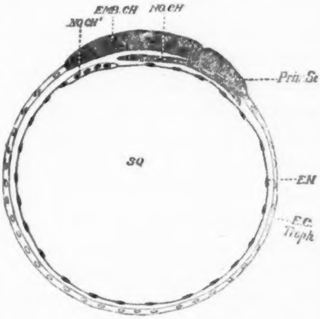


FIG. 3.—(Diagram C.)

The accompanying diagram (Fig. 3) represents (somewhat modified) the author's figure to show the relationship to each other of the mammalian germ-layers. The greater part of the central (fluid) cavity is surrounded by two layers,—the outer of ectoderm, the trophoblast, and within the ontogentic endoderm. The upper part of the figure shows the embryonic layers. The endoderm passes under the ectodermal embryonic shield (black). The posterior part of the latter (with white streaks) shows the area of the primitive streak, and from this runs forward under the embryonic shield a prolongation (*no.ch.*, black with white dots), forming the posterior part of the notochord, and laterally, though not shown in the figure, the wings of mesoblast. In front of this is seen a thickened part of the ontogenetic endoderm, which forms precociously the anterior end of the notochord (*no.ch.*) and to the sides some of the mesoderm. For further details see the author's excellent figures.

The essential difference between this hypothesis and that of Minot is at once seen. What the latter speaks of as endoderm cells are the

trophoblast cells of Hubrecht, which are ectodermal. Hubrecht shows conclusively that the endoderm originates from the embryonic knob, and not at its sides as is demanded by Minot's recent hypothesis. Hubrecht is more in accordance with Haddon, both as to the origin of the endodern from the under side of the embryonic shield, and in the ectodermal covering of the the early blastocyst.—T. H. M.

The Embryology of Gecko.—Dr. Ludwig Will gives, in the *Biologisches Centralblatt,* November 15, 1890, a short paper on the method of gastrulation of this lizard. At the posterior end of the embryonic shield is a mass of cells, called the primitive plate. The cells at this point are several rows deep, while over the embryonic shield the ectoderm is composed of a single layer of columnar cells, but with a few yolk-cells scattered beneath it. At a later stage the anterior end of the primitive plate forms a distinct invagination, the walls formed of a single row of cells. This sac pushes forward under the embryonic shield, between the ectoderm and the yolk-cells. The invagination cells spread out into a broad sac. There follows next an irregular fusion and absorbtion between the invaginated endoderm and the yolk-cells (endoderm also), so that the general cavity above the yolk, in which the yolk-cells were scattered, communicates with the invagination cavity, and hence with the outer world by means of the proximal end of the latter cavity, or blastopore. The upper walls of the invaginated cells go to form the notochord, and the rest of them go to form the mesoderm at the sides of the latter. The author believes that the Gecko furnishes grounds for comparing the reptilian with the amphibian gastrulation. The blastopore—or the open mouth of the invagination—extends backwards, and the two lips coming in contact fuse to form a primitive streak, so that what was previously only a theory —namely, that the primitive streak was formed by the fusion of the lips of the blastopore in Sauropsida, and whose opening in these was only represented by the neurenteric canal—is now shown to be a fact from the development of the Gecko.

Theory of the Mesoderm.[5]—Prof. C. Rabl has a long paper on the origin of the mesoderm of vertebrates. The paper is largely devoted to theoretical discussions, although based upon observations on the germ-layers of Selachians, birds, and mammals. The first part of the paper deals with the formation of the mesoderm in the above types, the second with the later differentiations of the mesoderm. It is unnecessary to give a full review of the paper here,[9] and we may confine

[5] *Morphologisches Jahrbuch*, No. 15, 1889.

See *Journ. Royal. Micro. Soc.*, Feb., 1890.

our attention to that part of it dealing with the gastrulation of the vertebrates. The Selachian gastrulation arose by the accumulation of yolk in the cyclostome egg, while the Amniote (reptiles, birds, mammals) gastrula arose from accumulated yolk to the amphibian egg. The resulting gastrulæ of Selachians and Amniota, the author attempts to show, are therefore fundamentally different. The Selachian (and Teleost) gastrulæ resulted from the addition of yolk to the endoderm cells of the cyclostome before the ectoderm had grown over the endoderm, and since the epibolic endoderm does not cover in the yolk, the blastopore in this group is represented by the whole margin of the embryonic shield. The blastopore mouth then is very large, and the (morphological) posterior end of the blastopore lies just in front of the embryonic shield, and the anterior or upper end of the blastopore lies at its usual position at the posterior end of the shield. This is, of course, the general conception. But for the Amniota the author believes the gastrula to be different in that it is not here represented by the whole border of the embryonic shield, but has a more limited extent. Rabl believes that the accumulation of yolk in the amphibian egg has been also in the endoderm cells, but, so far as he explains it, this must have taken place after (ancestrally) the epiblast had covered the (endoderm) yolk-mass so that the gastrula becomes reduced to the region of the primitive streak alone. Therefore it follows that one end of the primitive groove (just behind the embryonic shield) represents the anterior (upper) end of the amphibian blastopore, and the other end of the groove the posterior (lower of the amphibian). The anterior end of the primitive shield would not seem here to represent anything in particular ! Rabl supports his conclusion by arguments drawn from the formation of the mesoderm.

The author does not account for the large exposure of yolk outside of the blastopore in the Amniota gastrula as we find it in the bird and lizard ; unless indeed he supposed it to have actually broken through the ectoderm covering. Further, that the author's view is probably erroneous is shown in the occasional presence of a lengthened primitive streak running posteriorly through the area opaca, as seen and figured by Whitman. It has also, I believe, been seen since by others.

ENTOMOLOGY.[1]

Insects in Iowa.—Bulletin No. 11 (issued November, 1890) of the Iowa Agricultural Experiment Station contains four articles by Mr. C. P. Gillette, of considerable entomological interest. The first discusses the injuries and life-history of the Potato Stalk Weevil (*Trichobaris trinotata* Say), which has been unusually destructive in Iowa the past season. Mr. Gillette thinks that "half a million of dollars would fall far short of making good the loss that it has occasioned the state this year. In gardens where potatoes have grown year after year I have seldom found less than seventy-five per cent. of the stalks infested, and from this to ninety-three per cent. In field patches at a distance from where potatoes were grown last year I have found as few as twenty per cent. of the stalks infested, but in no case have I found the injuries less abundant than this." The next article discusses the Apple Curculio (*Anthonomus quadrigibbus* Say), and contains the first extended description of the method of oviposition of this insect. The two remaining articles discuss the currant-stem boring habits of *Hyperplatys aspersus* Say, commonly known as the Cottonwood Borer, and kerosene emulsion as a sheep dip and destroyer of parasites upon domestic animals. The experiments reported under this last heading are of great practical value. The author concludes with this paragraph: "I must say that after repeated experiments with kerosene emulsion, along with other substances commonly recommended for the destruction of vermin upon domestic animals, I feel certain that it is far ahead of anything I have tried when cheapness, effectiveness, ease of application, and freedom from possible bad effects are taken into account."

Indiana Insect Notes.—Bulletin No. 33 of the Purdue University Agricultural Experiment Station contains ten pages of entomological notes by Mr. F. M. Webster. The sub-titles are as follows: Experiments with the Plum Curculio; Notes on Strawberry Insects (*Tyloderma fragrariæ*, *Haltica ignita*, and the Field Cricket); Some Hitherto Unrecorded Enemies of Raspberries and Blackberries (*Solenopsis fugax*, *Limonus auripilis*, *Carpophilus brachypterus*, *Iulus impressus*, and *Cosmopepla carnifex*). Most of these notes are republished from *Insect Life*. The Plum Curculio experiments were made chiefly to determine to what extent the insect develops in native varieties of plums, and they showed that the insects do breed freely in them. The eco-

[1] Edited by Dr. C. M. Weed, Columbus, Ohio.

nomic points are summarized as follows: "(1) The variety of plum or apple whose blooming season covers the greatest period of time will best withstand the work of the curculio; (2) the planting of plum trees in the apple orchard will not protect the latter, and vice versa; (3) if anything is to be gained by using another fruit to draw off the curculio and protect the plum, the nectarine will probably serve as well as the apple; (4) adult curculio beetles eat the pulp of apples; (5) curculios will deposit their eggs in fruit hanging over the water; (6) the indications are that the Strawberry Crown Borer lays its eggs during March and April in the plants near the surface of the ground; (7) burning strawberry plants after fruit-picking may destroy the Crown Borer; (8) the common field cricket will eat strawberries."

Oviposition of the Apple Curculio.—Mr. C. P. Gillette has lately described the process by which the eggs of *Anthonomus quadrigibbus* are deposited. The description was originally read before the Iowa Academy of Science, September, 1890, and has since been published in Bulletin No. 11 of the Iowa Experiment Station (pp. 492–493). Mr. Gillette says: "I am not aware that any one has published actual

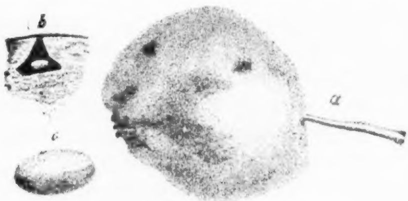


FIG. 1, *a*, apple infested by the Apple Curculio; *b*, egg-cavity, natural size; *c*, egg very much enlarged. Redrawn from Gillette.

observations on the method of oviposition of this insect. On the 13th of last June I was fortunate enough to see a female perform the entire operation, which was done as follows: First, a cavity (Fig. 1, *b*) was eaten in the apple as deep as the beak was long, the bottom being much enlarged and subtriangular in outline. The walls of the cavity converge to the opening, which is only large enough to admit the slender beak. When first noticed the beetle had begun her work and it was 30 minutes before the egg-cavity was completed. The beetle, almost immediately after withdrawing her beak, turned about and applied the tip of her abdomen to the small opening into the egg-cavity. After remaining in this position for about five minutes she walked away without turning about to inspect the work she had done.

I at once plucked the apple, and examined closely the identical spot where the beetle had been at work, and was surprised to find that there was no puncture to be seen in the skin of the apple, but only a minute brown speck. I found that the beetle had plugged the little opening with what appeared to be a bit of pomace, probably excrement, and she had done the work so nicely that I think no one would have suspected that this little speck marked the place of oviposition of this insect, unless he had seen such specks before, and knew what they signify. With a sharp knife a section was made through this egg-chamber, which I have endeavored to represent natural size, at Fig. 1, *b*, with the egg at the bottom.

Although it is almost impossible to distinguish newly stung fruit from external appearances, it becomes very easy after a few days when the infested apples become gnarly and ill-shapen, as shown in Fig. 1, *a*.

PSYCHOLOGY.

Professor Moll on Hypnotism.[1]—This work is a general résumé of what is known of hypnotism. The exposition by Prof. Moll covers most of the ground in an adequate manner, and is therefore well adapted for the instruction of the general reader. The author holds that suggestion is the efficient cause of the phenomena, and therefore regards the subject primarily as a branch of psychology, rather than of physiology. He states that most persons of healthy mental organization can be hypnotized, and that susceptibility, except in extreme cases, is not a mark of mental weakness. Persons of the nervous temperament are most susceptible, and idiots and insane persons can be hypnotized in a small proportion of cases only. Susceptibility is not confined to any race or nation, so far as known. The statements of the numerous investigators are subjected to rigid and rational criticism, and nothing is accepted or rejected without adequate evidence. The author pursues a judicial course in this respect, and refuses his assent to wholesale and uncritical scepticism, as well as to excessive credulity. Physiological explanations are frequently held in reserve as not proven, whatever degree of probability may attach to them.

The abundance of well-established facts now recorded in the literature of hypnotism has placed the subject within the domain of exact

[1] Hypnotism; by Albert Moll. The Contemporary Science Series. London: Walter Scott. New York: Scribner and Welford. 8vo. Edited by Havelock Ellis, 1890.

psychology, and its practical value to both mental and bodily therapeutics is admitted. Less attention is given to its importance to psychological science, and hence to philosophy. No support is given to the rather uncritical assertions frequently made as to the evidence offered by hypnotism for the existence of double or multiple personality of a single human individual. Not much space is given to the remarkable structural changes seen in the formation of red or necrobiotic figures on the skin, as the result of suggestion, although the reality of the phenomena is not challenged. The experiments of Jendrässik and Krafft-Ebing seem to place the facts beyond doubt.

Suggestibility is regarded as the principal characteristic of hypnosis as distinguished from somnambulism; hence most of the book is occupied with an elucidation of its mental and physical implications. Post-hypnotic suggestion receives a large share of attention. As an expert the author does not occupy so much space with the detailed accounts of experiments as with explanations of them in relation to other and normal mental states. The work is well adapted to enlighten the reader as to the essential significance of hypnotism. The citation of authorities is very full.—C.

Was it Hallucination?—I had a strange experience about nine o'clock this morning, which I hasten to put on record while all its details are fresh in my mind. My wife being quite seriously ill, I went for our family physician, about three blocks distant. I met him in an apothecary's shop, and asked him to come to our residence. He had one call to make near by, but promised to be with us very soon. I returned in a few minutes, coming into our cross-street at the east end of the block. As I came across a vacant lot just east of our house I happened to look out to the westward, when I saw our doctor just leaving the cross-walk and turning in as if to come straight to our place. It occurred to me that he was a little ahead of the time I expected him; but I hurried on to apprise my wife of his coming. I then went out to meet him. But *no one was in sight;* and at the moment I believed I saw him he was actually in a distant part of the town, at least several blocks away. He was detained, and did not reach us for a couple of hours, and was much surprised at my statement of having seen him. He said it was some sort of "hallucination,"—whatever that might be! He asked: "Was I not thinking about him?" Possibly I was, but with no idea of seeing him there and then. As to the man, I could not be mistaken. His dress, his long, flowing, almost white beard—every detail of his personal appear-

ance—were just as clear to my vision as when he really called, a little later. It was clear daylight; I was as wide awake as I am now while writing this item. Fifty years ago I listened to just such a story, and the narrator declared she "had seen a ghost." I am not in the least superstitious, and even had this been a "ghost," and I had known it, I should have felt no alarm, for I never knew those intangible folk to harm a living mortal,—even in the days when ghosts were so generally "believed in." Thinking the matter over immediately afterwards, I tried to recall any feature of this "second sight" which was in any sense abnormal. The only fact I could remember was that the doctor seemed to walk rather faster than usual, but I thought he only wished to overtake me before I entered the house. I thought he kept his eye on me, and continued to look at me in a very interested manner. I only wish I had kept my gaze upon him, and noted the spot and how he so completely vanished. I was never more thoroughly taken aback than when I went out to meet him, not more than thirty seconds after I saw him, *and no one was in sight!*—CHARLES ALDRICH, *Webster City, Iowa, December 15th, 1890.*

ARCHÆOLOGY AND ETHNOLOGY.

The Societe d'Anthropologie at Paris.—*A Sketch of Its Organization and Work.*[1]—The theory of evolution, and so the origin of species, which has been credited by many people to Charles Darwin, is in France credited, or attempted to be credited, to the naturalist Lamarck, and there was organized in 1884, under the protection, or at least the shadow, of the Society of Anthropology, an organization called the "Réunion Lamarck."

Born of the same idea as was the School of Anthropology, the Society of Anthropology, on the proposition of Monsieur Mathias Duval, inaugurated a course of lectures, which, under the name of "Conferences Transformiste," were intended to popularize the doctrine of evolution and the mutability of species, and so the origin of man.

In this course have been delivered the following lectures:

"The Development of the Eye," by Monsieur Mathias Duval, 1883.

"The Evolution of Morality," by M. Letourneau, 1884.

"Evolution of Language," by Monsieur Hovelacque, 1885.

"The Paleontologic Evolution of Animals," by M. G. de Mortillet, 1886.

[1] Continued from page 85.

"The Mental Evolution in the Organic Series," by Madame Clemence Royer, 1887.

"Microbes and Transformism," by M. Bordier, 1888.

"Transformism Français, Lamarck," by M. Mathias Duval, 1889.

The regular lectures are given usually at four o'clock in the afternoon, from November to May inclusive, in the audience hall of the Societe d'Anthropologie at the Musèe Dupuytren, 15 Rue de Ecole de la Medicine. While the lectures are open to the public and any one can attend, yet it is usual that those who propose attending regularly shall inscribe themselves, and obtain cards of admission. They can then be assigned to a particular seat, which they can have without disturbance during the course. Thus there is obtained a record of the number of regular attendants. These are shown in the following table:

Number of attendants at the regular courses of lectures given by the School of Anthropology from 1877 to 1889 inclusive:

1877–'78	8,384
1878–'79	9,294
1879–'80	10,289
1880–'81	9,719
1881–'82	7,611
1882–'83	8,343
1883–'84	8,315
1884–'85	9,019
1885–'86	8,742
1886–'87	8,709
1887–'88	7,075
1888–'89	11,786

The members of the Societe d'Anthropologie were actuated by a desire that their fellow-men should reap as much benefit as possible from their efforts, and so devoted whatever opportunities they might have, with whatever amount of labor it might be, to spread the news of their science, and to give such information to the people and education to the students as they could. So they have organized within themselves various societies, and have armed themselves in various ways for the accomplishment of their much-desired project. I can do no more with these than simply to mention their names and give a list of the works published.

There was organized a library called "Contemporaneous Science." A committee of direction and editing was appointed, and M. Reinwald, 15 Rue des Saint-Peres was chosen editor. The plan agreed upon

was to request or obtain from each professor or person having the requisite knowledge a manual, which should be small, compact, complete, clear, easily read. The manual was to be devoted to the science or specialty for which each professor was best qualified. There have been completed of this series the following:

Biology, by Dr. Letourneau, 3d edition, 1 vol., 518 pages and 112 engravings.

Language, by Hovelacque, 5th edition, 1 vol., 454 pages.

Anthropology, by Dr. Topinard, 5th edition, 1 vol., 576 pages with 52 engravings.

Esthetics, by Eugene Veron, director of the *Journal of Art*, 2d edition, 1 vol., 524 pages.

Philosophy, by M. Andre Lefevre, 2d edition, 1 vol., 640 pages.

Sociology in Its Relation to Ethnography, by Dr. Letourneau, 2d edition, 1 vol., 624 pages.

Economic Science, by Yves Guyot, 2d edition, 1 vol., 600 pages and 67 engravings.

Prehistoric Antiquities of Man, by G. de Mortillet, 2d edition, 1 vol., 678 pages and 64 figures.

Botany, by de Lanessan, 1 vol., 570 pages, 132 figures.

Medical Geography, by Dr. Bordier, 1 vol., 688 pages, with figures.

Ethics (la Morale), by Eugene Voren, 1 vol., 516 pages.

Experimental Politics, by Leon Donnat, 1 vol., 504 pages.

Problems of History, by Paul Mougeolle, 1 vol., 498 pages.

Pedagogy, by Issaurat, 1 vol., 512 pages.

Agriculture and Agronomic Science, by Albert Larbaletrier, 1 vol., 568 pages.

Physical Chemistry, and its Role in Natural Phenomena in Astronomy, Geology, and Biology, by Dr. Fauvelle, 1 vol., 512 pages.

Anthropological Library.—An organization much the same, and for the same purpose, but divided for convenience, is the one carrying the foregoing title. It is directed by another committee, much the same as the former, of which Mathias Duval, Hervè, Hovelacque, Letourneau, de Mortillet are respectively members. Their publishers are Lecrosnier & Babè, Place de Ecole de Medicine, Paris. The volumes which have been published by this organization are eleven:

I. Sociologic Physiology. Thulie, Femme.

II. Darwinism. Duval.

III. Moral Evolution. Letourneau.

IV. Precis d'Anthropologie, Hovelacque and Hervè.

V. Religions. Vison.

VI. Evolution of Marriage and the Family. Letourneau.
VII. The Family in the Roman Society. Lacombe.
VIII. Evolution of Property. Letourneau.
IX. The Negro of Africa. Hovelacque.
X. Comparative Pathology. Bordier.
XI. Prehistoric France. Cartailhac.

A similar organization was made for bringing out a dictionary of anthropologic science. The committee of publication or editors were Hovelacque, Issaurat, Lefevre, Letourneau, de Mortillet, Thulié and Veron, with a host of collaborators. The publisher was Monsieur Octav Doin, Place de l'Odeon 8, Paris. It appeared in parts, twenty-four in number, and has just been completed.

Society of Autopsy.—A party of substantially the same gentlemen, published, in 1876, their intention to form a society, the principal object of which was to receive members who should be willing to bequeath their bodies to the Laboratory of Anthropology for autopsy, that it might be dissected and studied in a scientific manner. Whatever may be said of the project, the aim and intention of these gentlemen was certainly unselfish.

The declaration published by these gentlemen as a foundation for the society, and a reason for its existence, was the importance of that branch of the science of anthropology which they called the physiology of psychology (psycho-physics), and with this their want of knowledge, say ignorance, concerning it, coupled with the lack of opportunity for its successful study. Experiments had been made upon animals, which, while they contributed largely to elucidate the problems of the physiologic functions, like the sensations, movements, secretions, etc., had been of slight avail in the study of the phenomena of human intelligence. They declared that this study was to be made only or first by investigation of the human brain, and this not only in its size, form, weight, and composition, but also in its convolutions and folds. The existing opportunities by means of dissection were meagre and unsatisfactory. They mentioned the well-known fact that the professor or student who now made the dissection was proverbially unacquainted with the subject during his lifetime, and consequently the powers of his mind were unknown. The persons best acquainted with the subject during his lifetime were last to know of the autopsy; and there appeared to be no possibility of, or opportunity for, comparison of knowledge between those who knew the subject in life and those who made the dissection. There was, said they, no chance for the living descendants or relatives ofthe deceased, either through their own

knowledge or the scientific knowledge of their own medical attendants, profiting from the discoveries which might be made by the dissection of the body of their ancestor.

They argued that public health and the interest of science has for a long period of time recognized the need for autopsy and dissection in the general education of the medical profession, while, they declared the study of psycho-physics had been largely ignored.

Je soussigné, désire et veux que,
après ma mort, il soit procédé
à mon autopsie par les soins
de la Société d'autopsie mutuelle.

Désirant en outre que mon
corps soit utilisé pour la science
je le lègue, notamment
mon cerveau et mon crâne
au laboratoire d'anthropologie,
qui en disposera à son gré,
telle est ma volonté expresse.

fait librement et spontanément
à Lille le 28 avril 1878

L. Faidherbe

They adopted a constitution, of which the following was the principal article:

"Each member, in pursuance of the end of science and humanity, announces herein the procedure which shall govern his autopsy. In order to avoid every obstacle to the execution of his will he will leave at his

death his testament declaring in general terms as follows: I will that after my death there shall be an autopsy practiced upon my body, that there may be discovered any malformation or hereditary malady, by means of which there can be employed the proper means to prevent their development among my descendants. I will that my body shall be utilized to the profit of the scientific idea which I have followed during my life, and to that end I bequeath my body, and notably my skull and brains, to the Laboratory of Anthropology, where it can be utilized in such mode as is believed to be best; and this is my wish spontaneously expressed. The portions of my body which are needed, after being used as aforesaid, are to be buried according to the usual method (or any other method may be indicated)."

A tracing is given on the opposite page of the oleograph testament of General Faidherbe, who died lately.

There are about 150 members of the Society of Autopsy. It has received the ministerial and legal authorization, and is now established upon a firm basis. The fees for membership are one dollar per year.

The importance was early recognized by these gentlemen of knowing everything concerning the physical and mental habits; and life of the subject, and therefore he was requested to make as full a description of himself and his physical and mental peculiarities as possible. His senses, sight, hearing, his understanding, his memory, was he a *visuaire* or an *auditaire*,—that is, could he understand and comprehend the meaning of words best through the eye or through the ear. So also, any peculiarities of his sensations, of the powers of his mind, and any observations upon his temperament or character.

The Laboratory of Anthropology has received several of the members of the Society of Autopsy, of which they have made dissection and investigation:

1. Jules Assezat, literateur, died June 24th, 1876, of heart disease, aged forty-five years.

2. Louis Asseline, literateur, died April, 1878, of rupture of the heart, aged forty-nine years.

3. Dr. Coudereau, died July 19th, 1882, of wounds of the intestines, aged fifty years.

4. Leon Gambetta, politician and statesman, died December 31st, 1884, aged forty-three years.

5. Dr. Adolphe Bertillon, professor, died March 1st, 1883, aged sixty-two years.

6. Gillet-Vital, civil engineer, died 1887, aged sixty-three years.

7. Sculptor Sauzel.

8. General Faidherbe.

The brains of the first five have been studied with care, and all their peculiarities described and written out. The brain of each has been accurately drawn, and by means of the stereograph they have been superposed, and drawings made comparing them.

I do not know whether it is by law or only by regulation, but the Laboratory of Anthropology has within the last few years received the bodies of all criminals executed in Paris, and there are to be now seen suspended from the usual ring in the top of the skull the articulated skeletons of these individuals, with their moulded brains laid upon the shelf beside them.

There were displayed either the brain, the skulls, or the busts of the following assassins who have been executed :

Lemaire, Menesclou, Prevost, Gagny, Marchandon, Rey, called Pas de Chance, Rivière, Pranzini, Barre, and two others, names unknown, one executed at Macon, the other at Montpellier.

I do not pursue this subject, for it will take me immediately into a catalogue and description of the 5,000 skulls and the numberless casts and studies, with all their numerous examples of anatomy, osteology, craniology, anthropogeny, which served to form the Musèe Broca.

The Institute of Anthropology at the Paris Exposition.—At the Paris Exposition of 1867 the science of anthropology was unrepresented.

In that of 1878 the Minister of Agriculture and Commerce, on the proposition of the Commissioner-General of the Exposition, decided upon a representation of anthropology, and confided its organization to the Society of Anthropology. It made a creditable, and for that time an important and instructive exhibit, but nothing to be compared with that in the Exposition of 1889.

In the Exposition of 1889 the Minister of Public Instruction requested the Society of Anthropology to make such display as was possible. A commission was organized, which made its appeal to its members in every part of the world, and to all kindred societies in France. I remember well in Paris, in the autumn of 1885, four years before the Exposition opened, the preparations which were being made. A family of bushmen from South Africa were being exhibited at a meeting of the society, under the management of Dr. Topinard. They were afterwards taken to the room for making plaster casts, and a cast of them made natural size. This was done in preparation for the Exposition, and when I visited it I saw the plaster casts of this family.

The members and societies appealed to for assistance in the Exposition of 1889 responded with alacrity, and, while the representation

was not the equal of that of the l'Histoire du Travail Retrospectif, under the direction of the Minister of Commerce and Agriculture, with Drs. Hamy, Topinard, and Cartailhac for managers, yet it was an important display, and coming as it did in the Department of Public Instruction, it showed opportunities to teachers to educate the people in this science of anthropology, especially the prehistoric, which might be productive of greater good and more far-seeing in its benefits to the general public than the finer and more extensive display in the other section.

Any one who has any knowledge of the subject of this paper can scarcely fail to have remarked the absence of all note of some of the most celebrated writers and workers in France on anthropology. The reason of this can easily be made plain. This paper has been devoted to the Society of Anthropology and the organization and laborers connected therewith. These other gentlemen, notable by their absence, while members of the Society of Anthropology and affiliating therewith, belong or are attached to other institutions of the same or kindred sciences, and their work is done in connection with their own organizations, and so does not appear with the Society of Anthropology.

Monsieur de Quatrefages is the Nestor of the science,—first in time, first in years, and first in wisdom. He is professor at the Museum of Natural History at the Jardin de Plantes. He delivers three lectures a week. His publications upon this subject are numerous, profound, and of great value.

There are other gentlemen eminent in science: Dr. E. Hamy, Consevateur of the Musèe of Ethnography at the Palace of the Trocadero; Monsieur Alexander Bertrand, Member of the Institute and Director of the Musèe St. Germain; M. Solomon Rainach, his assistant; M. le Doctor Emile Riviere; Marquis Nadaillac; M. Emile Cartailhac.[1]

A few words as to the members of the Society of Anthropology at Paris, and their domicil and professors, may not be uninteresting.

The honorary members number ten; the titular members are four hundred and twenty-six, of which two hundred and ninety-nine reside in Paris, and one hundred and twenty-four elsewhere; the national correspondents are sixty-three, while correspondents and associate foreigners number one hundred and eighty-three; making a total of six-hundred and seventy eight members. One-third of the regular members reside outside the city of Paris.

[1] M. Cartailhac, though a resident of Toulouse, spends so much of time, and does so much of his work in Paris as to be fairly entitled to be classed with the Parisian scientists.

The interest in anthropology on the part of the medical profession is shown by the fact that of the regular members no less than forty-eight per cent. are doctors.

The Society of Anthropology of Paris pays no rent. It has a subvention from the government of one thousand francs. Its annual dues for members are thirty francs. Its receipts amount annually to between eighteen and twenty thousand francs; its expenditures from one to three thousand francs less. It has invested in the *rentes d'Etat* the sum of forty-three thousand, five hundred and ninety-three francs, and had enough on hand before it commenced its present work in the Exposition to increase the amount of its cash capital to fifty-four thousand francs.

Permit me a few observations in confidence,—delivered as it were in executive session. There is no satisfactory reason why the Society of Anthropology at Washington, should not equal that of Paris. I know it will be said that Washington is not so large a city as Paris; but that is no sufficient reason. If you will but look over the names of the members who have attended their meetings, will but see the amount of work which they have done, the seriousness of their study, the profundity and detail of their investigations, the value to science of their contributions, and, finally, the zeal and fidelity of their members as exhibited in their work, you will conclude that if the Society at Washington should equal in these regards the Society at Paris it will deserve a higher rank and greater success than it possesses at present. If you had or would or could take in the ladies as members, that alone would make considerable increase in your membership, and also in your income. If you would have your meetings open to the public, and the needed conveniences provided for its reception and accommodation, this would also increase your membership. No person will join a society of anthropology until after he shall become interested in the science. All those who have had an original interest have already joined, and we must now recruit our membership from those in whom an interest has to be created. This can now be done only by private solicitation. If the public could be invited and attend the meetings of the society, we would soon see revived interest; and I have every faith that it would result in considerable increase of the membership roll. We have sufficient evidence to justify the conclusion that the attendance of the public upon the regular meetings would be large enough to be called successful. I think it deplorable that papers of the value and importance of those prepared by our members should be read before so insignificant a number. Those papers will compare in

scientific value and in public interest with the average lecture delivered at the National Museum, and the attendance thereof from 600 to 1000 at each lecture is to my mind proof that if the opportunity were offered the public would attend in large, if not in equal, numbers the meetings of this society, to hear the papers and discussions of its members. I think this fact illustrates the possibility of success in throwing open our meetings to the public. That it did not attend the meetings at Columbia College may have been due to the failure of detail in announcement, advertisement, etc.

I decline to stand as an apologist for our society; I do not excuse it in any comparison with that of Paris or London, on account of our youth as a nation or sparseness of our population. I would not plead the baby act as a reason for our poverty. We are located at the capital, and we possess all the advantages to be derived therefrom. We are a nation of sixty millions of people. We are as numerous, as rich, as capable, and have in every way equal opportunities with either the French, English, or any other nation to study the science of anthropology, whether prehistoric or otherwise, to do serious work which shall be of equal value; and, repeating what I said at the commencement of this chapter, I know no satisfactory reason why the Society of Anthropology at Washington should not be the equal in any and every respect with that at Paris, or with those in any other part of the world.

It has been an aspiration of mine that our society should be strong and powerful; that it should be at the head of kindred societies, and be the acknowledged authority of our science, not only in our own country, but that it should be its representative in foreign countries. I have hoped that every discovery of importance made within our country should be reported to it; that every question arising therefrom should be sent to it for resolution; that disputed points should be submitted to it for its opinion. I desire to see it conservative, dignified, learned, wise, and that it should occupy such acknowledged rank and speak with such acknowledged authority as that no anthropologist o prominence but would feel himself flattered by the use of its means to make known his opinions to the world, nor would one venture to publish to the world any new or untried theory in regard to the science except he had first sought to obtain our approval and the weight of our authority. I confess to a feeling of annoyance when the Hon. Charles Francis Adams, president of the Pacific Railroad, made or received from another the discovery of the statuette, said to be of human origin, and which came from the artesian well in Idaho, he should

have sent the object to the scientists of Boston for their opinion, and should have ignored this society or its kindred organizations in Washington. This would not have been so in either England, France, Belgium, Germany, Denmark, Sweden, Portugal, Spain, or Italy.

On a Certain Gesture of the Mouth Among the American Indians.—It commonly happens that the Zuñi and Navajo Indians make use of a gesture which has come to have an interest to me. In indicating that a person, or thing is far away, or where an event has happened or a person is at the time of speaking, these Indians, instead of turning the head that way or pointing with the finger, raise the head and project the lower jaw in the direction which they wish to indicate. As I am not familiar with the mode of gesticulation of other Indian tribes, I do not know how widely spread among our aborigines this habit is, but certainly it is very different from that of any of the white races.

When I first observed this peculiar gesture, aside from its unusual nature it made but little impression on my mind. It seemed quite too insignificant to be of any use in the study of Indian habits, and would probably never have occurred to me again but for an interesting experience among our New England Indians. On my return from the southwest last summer I went directly to Calais, Maine, to witness a snake dance, which I had hoped, but in vain, to see celebrated at the election of the "Governor" of the tribe. In talking with an old man of the tribe, I observed him use the same gesture several times for identically the same purpose as it is used among the Zuñians. The resemblance was so close that one could not imitate it. I was immediately reminded of my former experiences in the southwest. In both instances the gesture was very different from what would naturally be made by a white man for the same purpose.

The resemblance may seem too insignificant to mention, for it may have been a simple coincidence; but to me it had an ethnographical interest, and may not be without the same to others.

I have not studied Indian tribes enough to say how universal this gesture is among them. It may be characteristic of all our aborigines, and it may not be confined to them; but I am confident that the gesture was identical in the two instances mentioned, and it has not been my experience to see the same among white people.

This note is a plea for information. Is the gesture with the lower jaw to indicate distance or direction a characteristic Indian habit? Those whom I have consulted tell me that it is. If it is, we may well

wonder why such an insignificant habit should be so tenacious in a tribe so long in contact with the whites and so much affected by their civilization in much more important particulars as the Passamaquoddies.

It is conceivable that gestures like this certainly, spontaneous and in some respects involuntary, may furnish data of ethnological value.—J. WALTER FEWKES, *Boston, January 10th, 1891.*

MICROSCROPY.[1]

Methods for the Preservation of Pelagic Organisms.—The publication of the methods for the preservation of marine animals employed at the Naples Station[2] has called forth another contribution on the subject from Benedict Friedländer.[3]

Kleinenberg discovered some time since that picrosulphuric acid gave the best results with marine larvæ when it contained about 2 per cent. of common salt. Friedländer experimented on Hydromedusæ and Ctenophores with regard to this point, by placing some individuals in 1 per cent chromic acid, and others, of the same species, in an equal volume of the same solution, to which 2–3 per cent. of salt had been added; the results declared unmistakably in favor of the latter reagent. Still better results were obtained by fixing the specimens in a solution prepared by adding sea-water to a 30–40 per cent. solution of chromic acid until it was reduced to a ½–1 per cent. solution, the animals being exposed to its action for about an hour. An objection to the method lies in the fact that there is a danger of crystals of calcium sulphate separating out in the tissues when the specimens are transferred to alcohol. If the salts contained in the tissues are thoroughly washed out before the transfer, there will, on the other hand, be a shrinkage.

Friedländer obtained his best results by the prolonged action (5–10 hours) of an abundant quantity of 30 per cent. alcohol, followed by 50 per cent., 60 per cent., and 70 per cent. He concludes that a neither too rapid nor too slow extraction of the salts contained in gelatinous animals is more important for the prevention of shrinkage than the use of any fixatives. From many Medusæ, Salpæ, Siphonophores, etc., the salts can be more or less extracted before treatment with

[1] Edited by C. O. Whitman, Clark University. Worcester, Mass.

[2] See AMERICAN NATURALIST for September, 1890.

[3] *Biolog. Centralblatt.* Bd. X., Nos. 15–16.

alcohol by the action of fresh water, or a solution of chromic acid in distilled water. A trace of hydrochloric or nitric acid added to the alcohol dissolves some crystal deposits, but not those produced by calcium sulphate.

The greatest obstacle in the way of obtaining satisfactory preparations of Siphonophores is the tendency to split up into fragments which many of them, especially those with nectocalyces, show. Friedländer experimented with various salts in an attempt to discover a reagent which would kill without producing fragmentation, and obtained the best results with ammonia, zinc sulphate, and copper sulphate. The first of these reagents is, however, unsatisfactory for other reasons.

An interesting observation in connection with the use of these reagents is, that to obtain good results the reagent must have a certain minimal concentration; below this fragmentation occurs, increasing in intensity with the weakness of the reagent. This does not seem to depend on the rapid killing or fixation of the tissues by the strongest solutions, since such reagents as concentrated corrosive sublimate and strong nitric or acetic acids are much more rapid in their action than 15 per cent. copper or zinc sulphate, and yet produce excessive fragmentation.

The following method of preservation is recommended for the Siphonophores. The vessel which contains the animal in sea-water is held in a tilted position, so that the water is almost at the brim on one side. A solution composed of

Fresh water	1000 parts.
Zinc sulphate	125 "
Copper sulphate	125 "

is then poured in somewhat gradually, so that it may mix equally with the sea-water. The amount of the reagent to be used varies with the species under treatment. For instance, with Physophora it should be of about equal volume with the sea-water; but for Forskalia, which has numerous nectocalyces, it should be at least double that volume.

After the animal is completely dead, it should be placed in a fixing solution, for which Friedländer recommends 1 per cent. chromic acid in sea-water, with the addition for more delicate forms of strong osmic acid, or else $\frac{1}{8}$ per cent. osmic acid alone may be used.

Before transferring to alcohol the animal should be allowed to slip (the nectocalyces going first) into a glass tube, open only at one end. This opening should be plugged with cotton, and the tube suspended, the

open end downwards, in 50 per cent. alcohol. In about 12 hours the chromic acid will have been extracted, and the tube is then transferred for another 12 hours to 80–90 per cent. alcohol.

Finally, to get rid of the air-bubbles which sometimes form in the cavities of the nectocalyces, it is recommended that the specimen, before being placed in alcohol, should be transferred for a time to well-boiled sea-water, so that the air contained in the tissues may, to a certain extent, be dissolved out.—J. PLAYFAIR McMURRICH.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The Western Society of Naturalists held its annual meeting Nov. 12th and 13th, 1890, in the Physical Laboratory of Purdue University, Lafayette, Ind. In the absence of the president, Prof. C. R. Barnes occupied the chair. The report of the treasurer showed a balance on hand of $36.70. The presidential address by Chancellor C. E. Bessey dealt with "General Culture as an Object in Teaching Science." The society then discussed, "What science, and how much science, shall be required for entrance to college classes?" The general conclusion was that it did not much matter what science was required so long as it was well taught in the preparatory schools, but that none was better than that which is usually offered. Dr. D. H. Campbell gave an account of "Some Histological Methods in Botany." He usually killed and hardened vegetable tissues by immersion for from four to twenty-four hours in 1 per cent. chromic acid, stained *in toto* with some nuclear stain, cut by the paraffin method, and then stained again on the slide with Bismarck brown in 70 per cent. alcohol. This brings out the nucleus and the cell-wall in a beautiful manner. Turpentine is better for plant-tissues than chloroform, while a solution of Bismarck brown in turpentine stains too diffusely. Professor Hargitt exhibited a warm stage of his own construction, and described his method o making permanent mounts of Infusoria. He killed the specimens with Lang's fluid and stained with borax carmine. Dr. Kingsley described a new method of making serial sections with celloidin. Many of the same points are contained in a paper by A. C. Eyclesheimer in the *Botanical Gazette*, Vol. XV., p. 291, 1890. Prof. O. P. Jenkins described a lens support and directed attention to the Urodeles as affording excellent material for the demonstration of muscle growth. He also recommended the beetle Dytiscus for exhibiting the phenomena

of living muscle, using the blood of the beetles for a medium. Dr. Kingsley described a number of methods for killing marine invertebrates for histological purposes and for display. The following officers were elected for the ensuing year: Pres., J. M. Coulter; Vice Pres., S. Calvin, E. A. Birge, C. W. Hargitt; Treas., B P. Colton; Sec., J. S. Kingsley. The next meeting will be held next November, at St. Louis, Mo. Four states were represented at the meeting.

Indiana Academy of Science.—Indianapolis, Dec. 30th and 31st, 1890. T. C. Mendenhall, president.—Eighty-two papers were read, the following being those relating to the natural sciences: A recent find of Musk Ox remains in Indiana, Joseph Moore. A review of the Niagara Group in Bartholomew Co., Ind. (by title), J. F. Newsom. Shelby County "Earthquake," J. F. Newsom. Some new Crustacean Fossils, C. E. Newlin. Geological Section at Vincennes, W. J. Spillman. Sections of Drift in Vigo Co., Ind., J. T. Scovell. The highest old Shoreline on Mackinac Island, F. B. Taylor. The effect ot the Great Lakes on the ice sheet, F. B. Taylor. Preliminary notes on Genus Polygonum, Stanley Coulter. Aberrant fruit of *Juglans nigra*, Stanley Coulter. Aberrant forms of *Juglans nigra*—structural changes, D. T. McDougal. Value of minute anatomy in plant classification, Stanley Coulter. Notes on the apical growth of Liverworts, David M. Mottier. Notes on the germination of spores of Notothylus (by title), David M. Mottier. A remarkable oscillating movement of protoplasm in a Mucor, J. C. Arthur. Accelerating germination by previous immersion of the seed in hot water, J. C. Arthur. Notes on Guatemalan Compositæ, Henry E. Seaton. Parasitic Fungi of Indiana, E. M. Fisher. Circulation of sap, John Morgan. Distribution of Peucedanum in North America, J. N. Rose. Plants collected by Dr. Palmer in Arizona in 1890, J. N. Rose. Comparative structure of the roots of Osmunda and Botrychium, D. H. Campbell. Notes on the prothallium of the Osmundaceæ, D. H. Campbell. Notes on new Pucc ineæ, Henry L. Bolley. On the manufacture of plant infusions for the culture of Bacteria, Henry L. Bolley. The occurrence of *Veratrum woodii* in Decatur, Ind., W. P. Shannon. Some features of the occurence of *Viola pedata* var. *bicolor*, Joseph H. Tudor. Preliminary list of Knox County plants, W. J. Spillman. Introduction of noxious weeds, W. J. Spillman. Biological surveys, John M. Coulter. The flora of Texas, John M. Coulter. Weight of the seed in relation to production, Katherine E. Golden. The identification of Ghost-fishes, Charles H. Gilbert. The deep-water fishes of the Pacific, Charles H.

Gilbert. The fishes of the interior of Kentucky (by title), A. J. Woolman. Notes on Indiana Reptiles, Amos W. Butler. Observations on the habits of *Synaptomys cooperii*, Amos W. Butler. Chætodontidæ of the Sandwich Islands, O. P. Jenkins. Notes on structure of muscle cells in Salamanders, O. P. Jenkins. Geophili in Jefferson County, Ind. (by title), Geo. C. Hubbard. Notes on some Actinia, W. F. Glick. Some notes on Indiana birds, B. W. Evermann. Contribution to the distribution of the fishes of the West Coast of North America, O. P. Jenkins and B. W. Evermann. Sailor Spiders on Lake Maxinkuckee, O. P. Jenkins. The Butterflies of Indiana, W. S. Blatchley. The Batrachians and Reptiles of Vigo Co., Ind., W. S. Blatchley. The death of Salmon after spawning, D. S. Jordan. The fishes of the upper Columbia and the Shoshone Falls, D. S. Jordan. Eels of America and Europe (by title), D. S. Jordan and B. M. Davis. Food habits of the Blue Jay, C. W. Hargitt. Notes on *Hydra fusca*, C. W. Hargitt. Acridiidæ of Vigo Co., Ind., W. S. Blatchley. On a bird new to the State fauna, W. S. Blatchley. On *Cnicus discolor* as an insect trap, W. S. Blatchley. Relation of the number of vertebræ in fishes to the temperature of water, D. S. Jordan. Notes on Indiana Mammals, B. W. Evermann and A. W. Butler. Audubon's old mill at Henderson, Ky., B. W. Evermann. The range of the Evening Grosbeak in the winter of 1889–'90, Amos W. Butler. Carolina Parakeet in Indiana, Amos W. Butler. The colors of sounds, Gustaf Karsten. The colors of letters, D. S. Jordan. A list of the Orthoptera of Illinois, with descriptions of new species and observations on the songs and habits of little-known species (by title), Jerome McNeill. Description of a new æsthesiometer, William Bryan. Researches on the tactual perception of distance, William Bryan. Researches on reaction time, William Bryan. Fishes of the Wabash Basin, B. W. Evermann and O. P. Jenkins. Hypnotism, W. B. Clarke. The presidential address, "The Work of the U. S. Coast and Geodetic Survey," was given on the evening of the 30th.

The Nebraska Academy of Sciences was organized at Lincoln, Neb., Jan. 1st, 1891, with seventy-three members. A short constitution was adopted, and the following officers were elected: President, Dr. J. S. Kingsley; Vice President, Prof. G. D. Swezey; Secretary and Treasurer, Prof. W. E. Taylor; Custodian, Lawrence Bruner; Directors, Mrs. E. O. Nettleton, W. H. Skinner. The Academy will hold its annual meeting in Lincoln, the week following Christmas, and will hold a field meeting each spring at some interesting point in the state.

SCIENTIFIC NEWS.

Dr. Clarence M. Weed, editor of the entomological department of the AMERICAN NATURALIST, and present entomologist to the Ohio Experiment Station, has been elected professor of zoology and entomology at the New Hampshire College of Agriculture and Mechanic Arts, located at Hanover, N. H., in connection with Dartmouth College. He will move to Hanover during the coming spring.

Alexander Winchell, Professor of Geology and Paleontology in Ann Arbor University, Michigan, died on February 20th at Ann Arbor. Professor Winchell was one of the best-known geologists, and was a distinguished author of works of original research, as well as educational books. He was long State Geologist of Michigan, and during his incumbency he published some important monographs of the Paleozoic geology and paleontology of his State. He subsequently assumed the Professorship of Geology in Vanderbilt College, Tennessee, from which school he was retired because of his belief in the doctrine of organic evolution. He was afterwards Chancellor of the University at Syracuse, New York, from which place he returned to Ann Arbor. At the time of his death he was President of the Geological Society of America. His latest work has been in the Archean and Huronian regions about Lake Superior.

Professor Winchell produced a number of works of a popular character, which have greatly stimulated the taste for geological science in this and other English-speaking countries. He was a pleasant lecturer, who instructed his classes, and aroused their interest in his favorite science. His treatment of the subject was within the reach of popular audiences, as it was not his specialty to deal with the finest subtleties of thought. His method was rather bold and comprehensive.

Professor Winchell was a handsome man of strong physical build, and of a quiet and somewhat phlegmatic temperament. He was honest and amiable, and personally attractive to many people. He has left many friends. He was born in the State of New York in 1824.

Professor Felipe Poey, the most famous naturalist yet produced in any Spanish country, died at Havana, Cuba, Jan. 28th, 1891, in the ninety-second year of his age. Poey was born in Havana, of French-Spanish parentage, in the year 1799. He was educated for the profession of law in the University of Havana, but his tastes for the nat-

ural sciences were very strong, and in 1826 he went to Paris, where he spent five years in the study of zoology. Here he was a friend of Cuvier, and one of the founders of the Entomological Society of France. After his return to Havana, Poey devoted his life to the study of the rich fauna of his native island, and especially to making known its fishes. Of the many new species of Cuban fishes described by Poey, one hundred and ninety-one are recognized as valid in the latest catalogues. The writer was told by a fish-dealer in Havana that "for twenty years Don Felipe was in the markets every day when at noon the fishes came in from the boats, and that he knew more about the fishes of Cuba than the fishermen themselves."

In 1842 Poey was appointed to the Chair of Comparative Anatomy and Zoology in the University of Havana, a position which as active and emeritus professor he held until his death. His publications were numerous, in Spanish and French, and occasionally in English. The most important are "Memorias Sobre la Historia Natural de la Isla de Cuba," "Repertorio Fisico-Natural de la Isla de Cuba," and "Enumeratio Piscium Cubensium."

The great work of his life, "Ictiologia Cubana," is still unpublished. This book contains detailed descriptions and life-size figures of seven hundred and fifty-eight species of Cuban fishes. A duplicate of its manuscripts has been purchased by the Spanish government at a cost of $5,000, and has been exhibited at several European expositions, but the prospect of its publication is still remote.

Poey has long been recognized as one of the most intelligent and faithful workers in faunal zoology. His writings are characterized by an entire lack of prejudice, his sole purpose being to place on record the facts which come before him. His interest was maintained up to the time of his death, a fact the more remarkable as outside of his own family not a person in Cuba had any real knowledge or appreciation of his work. His long life has been a very happy one, and few naturalists of our day have better deserved the good will and respect of their fellow-workers than the genial and cheery Professor Poey.—D. S. JORDAN.